PUBLIC WORKS

Nov. 1951

CITY, COUNTY AND STATE

ow to Design Cathodic Protection for your Water Tank

ew York's Problems and Methods of Refuse Collection

avement Design for Roads and Airfields

urbine Pump Applications in Water Supply

olving Public Works Problems: Six "Shorts"

pecial Plant Treats Sewage Sludge

Albert H. Ullrich, shown at work at his desk, is Superintendent of Water and Sewage Treatment for Austin, Texas. **More data on page 22.**

This 144-page book shows over 5,500 on-the-job truck running cost reports . . . from owners in every state in the U.S.A.

Here's *another* Ford first! New "Final Results" record, based on over 5,500 running cost reports, lets you check what truck running costs can be in over 195 different jobs!

50 million mile Economy Run shows HOW LITTLE IT COSTS to run a FORD TRUCK in your kind of work!

● The purpose of the Economy Run was to give businessmen and truck operators dependable truck running cost figures, based on actual trucks working on actual jobs. These figures are published so that you can:

SEE before you buy, just how little it *does* cost to run Ford Trucks.

SEE what size trucks cost the least to run in various kinds of work.

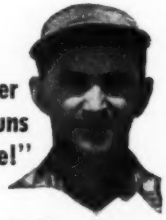
SEE how your running costs compare with others in your kind of work.

Are all running cost figures included? Yes! The "Final Results" book shows all gas, oil, maintenance and repair costs reported by users of 1948, 1949 and 1950 model Ford Trucks.

Can this book help YOU? Yes! It is a service to businessmen which may save you real money. It gives you a standard of comparison on one of the big expense items in your business.

What does the book show? The Economy Run book shows that in your kind of business, even the biggest Ford Trucks haul for only a few pennies a mile, and that *all Ford Trucks cost downright little to run.* See the book at your Ford Dealer's today!

ROY GEETING,
Construction Man,
Eaton, Ohio, says:



"My Ford hauls over 6 tons of gravel—runs for only 3 1/10¢ a mile!"

Mr. Geeting was one of over 250 Heavy Construction Men, shown on pages 43 to 46, who took part in the Run. His Ford F-6 Dump traveled 21,003 miles at a cost of $639.83 for gas, oil, maintenance and repairs. Check *your* truck running costs with those of other heavy construction men whose loads and working conditions are similar to yours!

For the right truck for your job . . .

See your Ford Dealer today!

See "Ford Festival" starring James Melton on NBC-TV.

Specify

CHICAGO "PAKAGE" PLANTS

ISN'T IT TIME *YOU* MAILED ONE OF THESE CARDS?

THE attached business reply card is here to help you get the latest information on products that will make your work easier. Several thousand engineers and public works officials find it's the easy way to keep up-to-date on new equipment and material. And your library will benefit if you request the valuable handbooks so many manufacturers offer free. So take a minute to look over pages 79 to 89 of this issue, then circle the numbers on the handy reply card, sign and mail. No stamp needed.

for a small
assured the
"Pakage"
to provide
it to plants
250 Chicago
excellent rec-

of operating
hey are free
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ingenious automatic features of Chicago "Pakage" Plants simplify operation and assure successful performance. Former farmers, salesmen, coal-miners and truck-drivers — without previous experience — are operating existing plants. Operator training service by Chicago Operating Sanitary Engineers is provided with each plant if desired.

Specify Chicago "Pakage" Plants, proved by 17 years of successful performance.

17 YEARS OF PROVED PERFORMANCE

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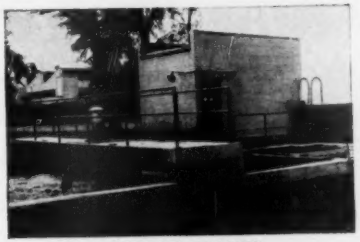
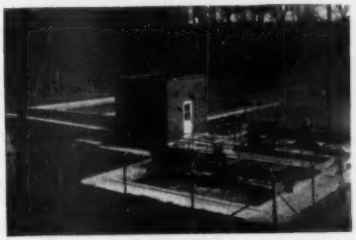
Ladd, Ill.



• FOR INDUSTRIAL PLANTS
Goodyear Tire & Rubber Co., Topeka, Kan.



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CHICAGO PUMP COMPANY

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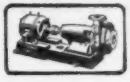

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Swing Diffusers, Stationary Diffusers, Mechanical Aerators, Combination Aerator-Clarifiers, Comminutors.

MORE than a family resemblance

Regardless of what size Oliver Industrial Wheel Tractor and Ware Loader you buy . . . "66", "77", "88" . . . you get the identical superior design and performance features in each.

The smaller tractor-loaders are not built down to a price level . . . they are built up to the same quality standards as the larger models.

In the tractors, you get the famous Oliver *plus* power and easy maneuverability that get you in and out of the rough spots . . . *fast!*

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Your Oliver Industrial Distributor will be happy to show you what the "more than a family resemblance" in Oliver-Ware Tractor Loaders means to you in lower cost operation. And see the Oliver color film "Task Force on Wheels."

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Industrial Division: 19300 Euclid Avenue, Cleveland 17, Ohio

A complete line of industrial wheel and crawler tractors

Now's the time to mail this month's Readers' Service card.

PUBLIC WORKS *Magazine*

Edited by W. A. Hardenbergh and A. Prescott Folwell

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THE ENGINEERING AUTHORITY IN THE CITY-COUNTY FIELD

THE EDITOR'S PAGE

Salary Stabilization is Unjust to Engineers

ENGINEERS have generally been among the lower paid of the professions and the existing regulations in respect to the control of salaries (or wages) strikes them with a serious impact. Under present conditions, the only way by which they can materially improve their economic status is by changing jobs. Any excess of this is undesirable. Engineers are in very short supply and they should be used where their skills will contribute most to the country. They should not be left subject to the temptation of a marked increase in pay for a job where their abilities will not be utilized fully.

The relatively low salaries paid engineers in the past have been due to several reasons. Among them are the fact that the shortage of engineers was not fully recognized before pre-Korea days; there has been a slow realization of their essential values in the national economy; and we lost five years output of engineers during the war. The young men who have been graduated since the war have not yet had time to get out of the low-pay ranks.

It is unjust, and it is equally unwise, to hold the pay of engineers at present low standards. Recognizing this, a few of the leaders in the engineering field have taken up the matter with the Congress. However, action is most unlikely this year. The matter has also been taken up with the Salary Stabilization Board and the reply is a model of Government gobbledygook and hedging. Everyone interested in a fair pay deal for engineers should get in touch with his Congressman and his Senator to insure that some adequate action is taken at the next session of Congress.

It Used to be "Shall We?" Now it is "We Must"

IT IS no longer a question whether a city or county should buy modern construction and maintenance equipment. To-day the question is: "What type or piece of equipment will we buy?" No community can any longer rely on the pick and the round-pointed shovel, once the standard tools of the workman. With wage rates six or eight times what they were in the heyday of the pick and shovel, no community can afford to do its work by hand. Moreover, it would be impossible to-day to get enough labor to perform the work of building and maintaining our necessary utilities at the rates of speed made possible by machinery and necessary to modern progress. How long would it take to build a modern highway by hand? Our traffic needs would not permit the ensuing delay.

What equipment to purchase depends on many local conditions. The kind of work to be done and the size of the community are two important factors. A small city or county may need an all-purpose tool; the larger city or county can afford specialized equipment. Whatever the needs, there is equipment available to-day to meet them.

To show what equipment officials charged with public works have found to be most useful, Public Works Magazine, over the past year, has published hundreds of brief descriptions telling of specific jobs done. We believe these will help in better equipment selection, for they illustrate many new and better uses of equipment for reducing costs and speeding the work. And they illustrate, too, the skill and ability of our public works engineers.

Engineers Should Write More About What They Do

THERE are at least two sound reasons why engineers should write articles describing the interesting jobs they do. First, through the resulting interchange of experiences and ideas, the practice of engineering develops more rapidly, and to the advantage alike of the writer and the reader. Second, the publication of an article adds to the reputation of an engineer, both in his home town and in his profession, and also tends to enhance the profession of engineering.

There is no secret in technical writing; fancy words are not needed; "dolling up" of articles is unnecessary. The work to be done, the methods and equipment used, and the results attained, with enough detail so the other fellow can understand and benefit, are all that are necessary. A photograph, sketch or drawing will help.

Information is of value only to the extent to which it is available to others. Through articles in engineering publications, thousands may benefit. This magazine cordially invites its readers to contribute of their knowledge and skill for the benefit of others, and of themselves.

17,150 WASTE KING *Pulverators* in one community!

dwarfing all other city-wide garbage disposer installations...

"No Garbage Trucks Travel the Streets"

LAKEWOOD PARK
California

WORLD'S BIGGEST GARBAGE-FREE COMMUNITY!

In this gigantic Southern California community, every home and restaurant is being equipped exclusively with Waste King Pulverators. History is being made, setting the trend for the establishment of Garbage-free Communities throughout America. Here is actual proof of big-scale garbage disposer installations...of the Community-wide Garbage Grinder Plan in action!

Think what this workable Plan of Garbage-freedom can mean to your community:

- NO INSANITARY, UNSIGHTLY SPACE CONSUMING GARBAGE PAILS IN THE ALLEYS, BACKYARDS OR STREETS.
- NO ATTRACTION (BREEDING PLACES) FOR FLIES, RATS OR VERMIN.
- HEALTH AND SANITATION ARE FACTORS YOUR COMMUNITY MUST CONSIDER!

The Community-wide Garbage Grinder Plan reduces costs...allows for lower taxes...and relieves the Public Official of the grievous and burdensome liability of financing and selecting garbage grinders.

Of outstanding significance to community planners, is the experience of providing "Community-wide, Garbage-free Living," originated by the Given Manufacturing Company, America's largest independent producer of garbage disposers.

Let us show you how the Community-wide Garbage Grinder Plan can work for your Community.

Waste King KITCHEN PULVERATOR CONTINUOUS FEED

Send for illustrated brochure written specifically for Public Officials.

Dept. PW11, Given Manufacturing Co.
1250 Wilshire Blvd.,
Los Angeles 17, Calif.

Please send my complimentary copy of "Community-wide Garbage-free Living." I am interested in the Community-wide Garbage Grinder Plan.

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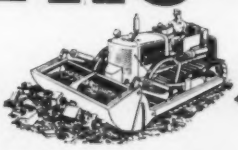
City_____ State_____

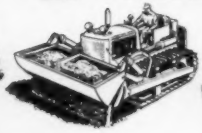
a product by GIVEN Mfg. Company
LOS ANGELES, CALIFORNIA

"Turns Garbage

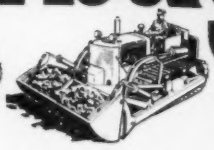
Prepares the trench



Spreads and compacts garbage



Brings up and spreads cover



Irons and compacts the cover

SANITATION SPECIAL in Sheffield, Alabama—an International Crawler mounting a 2-yard Drott-Bullclam has just spread a pile of refuse, is about to crush and iron it out under the specially curved Bullclam front. Other International crawlers available with 1 and 3-yard Bullclams.

Now's the time to mail this month's Readers' Service card.

into Gold" *says Sheffield, Alabama*

How to increase property values with an International Crawler-Drott Bullclam unit . . . the only unit specially built to do all four steps of the complete sanitary fill job.

Taxpayers in Sheffield, Alabama, were curious about their new International Crawler-Drott Bullclam, so its first garbage-disposal site was a ravine smack on the main highway and next to an expensive housing development. This way, everybody could see the Bullclam at work and form his own opinion.

People liked what they saw. Refuse disposal was cheap and neat. The property—formerly worth $300—was sold for $10,000, and a long list of citizens now want similar sanitary fill on their land.

Sheffield Sanitation Superintendent H. B. Fouche says, "Our garbage is turning to gold, as the Bullclam increases property values so much the owners can hardly believe it. As a result, the nearby city of Florence has bought a Bullclam, too."

The International Crawler-Drott Bullclam combination is the ONLY one-man equipment specially designed to handle all four steps of the complete sanitary fill job. It scoops out the excavation, spreads the refuse, crushes and grinds the bulk with brute International Crawler power behind the curved Bullclam front. Then it spreads and grades the cover dirt to finish the job.

It's a one-man wonder! Ask your International Industrial Distributor for details. Or write today to:

Drott Manufacturing Corporation, Milwaukee 8, Wisconsin
International Harvester Company, Chicago 1, Illinois

NEW LAND FOR OLD. An eroded gully is turned into beautiful, usable home sites by the Bullclam.

SMOOTH AND EASY, the Crawler-Bullclam spreads and grades a layer of clean earth over the compressed refuse.

BULLCLAM BY

DROTT

POWER BY

INTERNATIONAL

POWER THAT PAYS

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AS THE YEARS ROLL ON

THIS ROAD PAYS OFF HANDSOMELY...

Blending with every landscape and free from glare, roads built with Tarvia* road tar take the strain out of driving. They are self-healing under impacting traffic.

The heat-absorbing qualities of black roads built with Tarvia* road tar make them easier to keep open in winter, as snow and ice melt more quickly. And they are not affected by chemicals used to remove snow and ice.

because

1. Roads built with Tarvia* road tar improve with age. Occasional applications will renew the life of the surface, and replace worn-away material.

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4. TARVIA road tar is unaffected by gasoline, kerosene, or moisture. It retains its original properties.

5. TARVIA road tar holds the aggregate tightly in the surface, and produces a gritty surface which is lastingly skid-resistant.

6. TARVIA road tar may be applied at moderate temperatures, and with ordinary equipment.

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YOUR WHOLESALER

. . . A FRIEND IN DEED!

Your wholesaler can be one of your best friends today. Through his cooperation you can do a better job yourself.

Consider him not only as a source of supply for products that you need to satisfy your customers, but rather as a co-worker whose purpose is similar to yours.

He acts as the liaison between you and the manufacturer—in fact, many manufacturers. Representing you in your community, he endeavors to bring within your convenient reach those brands and types of products which he thinks will best serve your needs.

He is obviously in a position where he can make careful selections in your interests, and in the process gain much helpful information to pass on to you. If he doesn't stock some particular item you need, he can use his experience and acquaintance in the market to procure the product you are after.

Once in a while he even becomes a troubleshooter. Being on the local scene, he can render real assistance when something goes wrong on one of your jobs.

As we said at the beginning, your wholesaler can be your best friend. He can appreciate your purposes and efforts. This, together with a genuine spirit of cooperation, should prove a helpful and profitable operation of mutual benefit.

WOLVERINE TUBE DIVISION, Calumet & Hecla Consolidated Copper Company, Inc., *Manufacturers of seamless, nonferrous tubing,* 1451 Central Ave., Detroit 9, Mich. Plants in Detroit, Mich. and Decatur, Ala.

BUY FROM YOUR WHOLESALER

SPECIFY CLAY PIPE AND BE SURE

CLAY PIPE IS THE *ONLY* PIPE THAT INCLUDES ACID TESTS IN ITS A.S.T.M. SPECIFICATIONS

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703 Ninth & Hill Bldg., Los Angeles 15, Calif.
311 High Long Bldg., 5 E. Long St., Columbus 15, Ohio

SPECIFY *Vitrified* CLAY PIPE

WRITE FOR DETAILED INFORMATION

Additional information and data on Vitrified Clay Pipe, Wall Coping and Clay Flue Lining sent FREE on request. State your specific questions. Simply contact the regional office nearest you.

C-451-1

FULL WEIGHT - - - FIRST QUALITY

All McDonald water works brass is 85-5-5-5, according to water works standards. Here is our new Copper to Copper Stop and Drain, E-3519. Its full-sized, free water-way, backed by McDonald workmanship assure trouble-free operation. Sizes ⅜, ½, ¾, 1 inch. We will be glad to mail on request, literature covering our full line of Brass Goods. A. Y. McDonald Mfg. Co., Dubuque, Iowa

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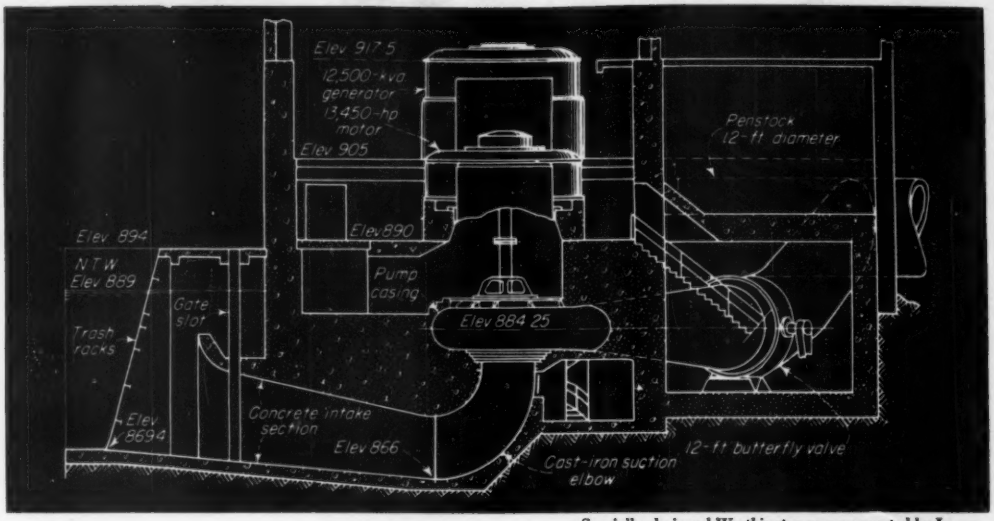
EST. 1856

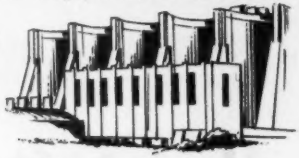
McDonald



Specially-designed Worthington pump operated by Lower Colorado River Authority of Texas, at Buchanan Dam.

Big Pump Banks Hydro Energy

at 360,000 gpm—and low cost!



It's one of the largest in the world—the Worthington pump used for water storage at Buchanan Dam on the Colorado River in Texas.

There are three 12,500 kva generators at Buchanan Dam. The pump is used in connection with the third one. It uses low-cost off-peak energy to store water which can be used at times of peak load.

The cost of running the pump is only one-quarter the value of the peak energy it helps to produce.

This specially-designed pump is rated at 362,000 gpm under 120 ft head, and is driven by a 13,450 hp motor. It has a 164 rpm shaft, bottom-suction, twin-volute, closed-impeller design. The impeller's center line is 4.75 ft below normal tail water level. So the pump is primed at all times and there is no cavitation of the impeller.

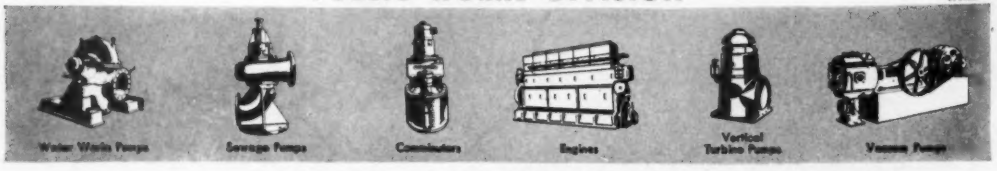
Standards—Specials—a Complete Line

It's another case that proves *there's more worth in Worthington*—proves that Worthington can always supply the right pump for the job. It makes no difference whether tremendous quantities of water are involved as at Buchanan or the relatively smaller amounts required by the average municipality. With the broadest and most complete line in the world, it is often possible to select or adapt a standard model to meet specifications. For detailed information, address Worthington Pump and Machinery Corporation, Public Works Division, Harrison, N. J.

WORTHINGTON

PUBLIC WORKS DIVISION

W.1.5



Now's the time to mail this month's Readers' Service card.

Rugged "Cat" Diesels speed work on thousands of public works projects. Here two Gardner-Denver portable compressors, each powered by a "Caterpillar" D13000 Engine, are used to drive piling for shoring an underpass in Washington, D. C.

There's a big job ahead

The job of maintaining more than three million miles of roads and streets is a vital part of America's fight to be strong and stay free. And it won't be easy. We're entering a critical period that will separate "the men from the boys" in the field of construction and maintenance equipment.

Military needs and Defense Rated Orders are taking their share of "Caterpillar" production. Shortages of steel and other materials add to the difficulty of supplying the demand for new machines. This means that *present equipment must be kept in use.*

"Cat" Diesel Engines, Tractors and Motor Graders are built with the stamina to stand up and serve you faithfully for a long time. But how they're operated and maintained is up to you. Good care pays off.

You can add many hours to equipment life if you follow sound maintenance practices. Anticipate your parts needs. Talk it over with your "Caterpillar" dealer. He is qualified to give competent opinion. If a part is not readily available, he has the tools and knowledge to rebuild many worn parts—and keep your equipment on the job.

CATERPILLAR TRACTOR CO. • PEORIA, ILLINOIS

You're the Doctor

Don't let your engine overheat. Maintain the cooling system, keeping it free of scale, rust and sediment. Use soft or treated water and, when freezing temperatures exist, protect your engine with anti-freeze. Clean the radiator periodically, removing foreign matter from the core by brushing or washing. Use chemical flushing solutions. Prevent engine troubles which come with overheating.

REREAD YOUR OPERATOR'S INSTRUCTION BOOK
GOOD CARE CAN ADD MANY EXTRA HOURS OF EQUIPMENT LIFE

CATERPILLAR
REG. U. S. PAT. OFF.

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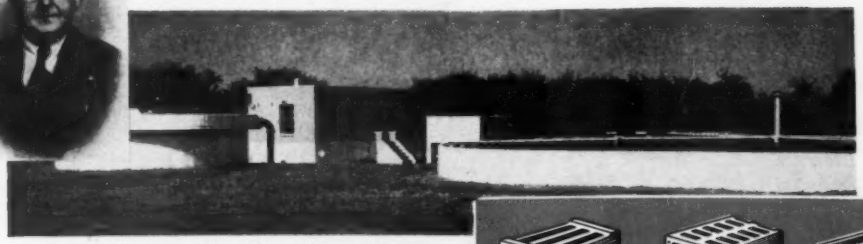
TRACTORS
MOTOR GRADERS
EARTHMOVING EQUIPMENT

For Better Trickling Filter Results

Don W. Frush
Frush Engineering Co. (Formerly W. B. Rollins & Co.)
Kansas City 6, Mo.



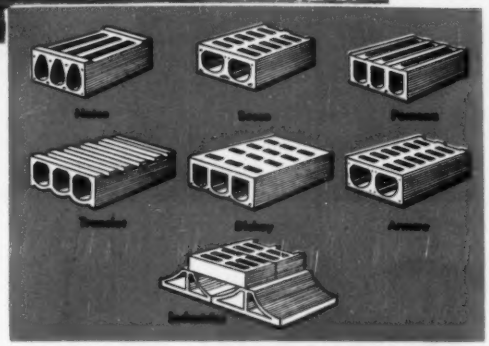
Sewage Treatment Plant, Mount Vernon, Mo.
Contractor: Don P. Pray, Inc., Joplin, Mo.

1. Use TFF Institute SPECIFICATION Underdrains

Trickling Filter Floor Institute *specification* underdrains are used in all modern filters where better results and trouble-free operation are desired. They are scientifically designed for that purpose and made of the finest quality vitrified clay. The size of the top openings insures proper ventilation of all the filter media and free discharge of the filter effluent. The run-off channels are extra smooth for non-clogging, quick drainage.

These blocks will carry applications up to 50 MGAD. Unskilled labor can lay them easily because they are light-weight and self-aligning. And the blocks are strong enough to work on after laying and to support safely even very deep filter media. They are best for all kinds and shapes of filter.

On *your* next filter, use the best equipment you can get . . . and give it a specification floor of *Vitrified Clay Filter Bottom Blocks*. Ask any member of this Institute for full engineering details. Write today.



These blocks are Easy to Lay, Acid Resistant, Proved by Use and Won't Clog

2. Use Good Equipment

The Mount Vernon, Mo., sewage treatment plant was designed for a population of 4,000 and has a capacity of 400,000 gpd. It consists of 30′ dia. Dorrco primary and secondary clarifiers; 100′ dia. PFT Rotary Distributor; 30′ dia. PFT Floating Top Digester; sludge beds and control house. The latter contains the lift pumps, sludge pumps, laboratory and accessory items.

An important factor in the eminently satisfactory operation of this plant is the top quality floor in the trickling filter. The designer's plans called for a *specification* floor . . . a *Vitrified Clay Filter Block* floor . . . the best kind of filter floor available.

TRICKLING FILTER FLOOR INSTITUTE

Pomona Terra-Cotta Co.
Pomona, N. C.

W. S. Dickey Clay Mfg. Co.
Kansas City 6, Mo.

Bowerston Shale Co.
Bowerston, Ohio

Texas Vitrified Pipe Co.
Mineral Wells, Tex.

Ayer-McCarel-Regan Clay Co.
Brazil, Ind.

Industrial Materials Co.
Philadelphia 34, Pa.

National Fireproofing Co.
Pittsburgh 22, Pa.

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NOW...do all three trench-completion jobs with one machine

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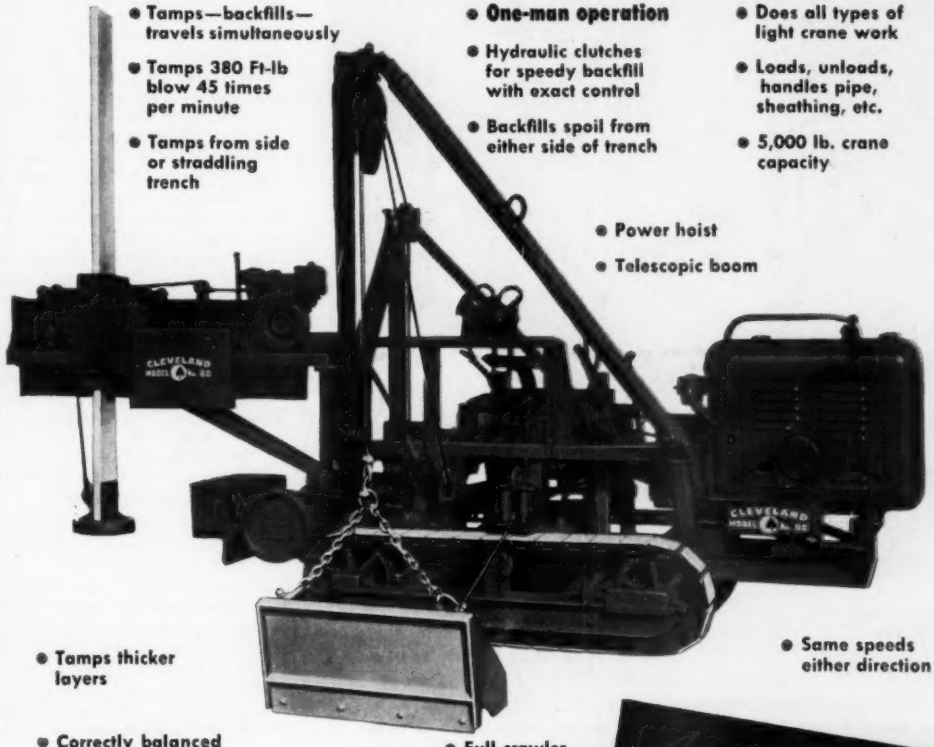
the only machine of its kind!

IT TAMPS! IT BACKFILLS! IT LAYS PIPE!

- Tamps—backfills—travels simultaneously
- Tamps 380 Ft-lb blow 45 times per minute
- Tamps from side or straddling trench
- **One-man operation**
- Hydraulic clutches for speedy backfill with exact control
- Backfills spoil from either side of trench
- Does all types of light crane work
- Loads, unloads, handles pipe, sheathing, etc.
- 5,000 lb. crane capacity
- Power hoist
- Telescopic boom



- Tamps thicker layers
- Correctly balanced steel backfill board
- Full crawler maneuverability
- Same speeds either direction

A MACHINE THAT BELONGS IN YOUR '52 PLANS

Get more work for your budget dollar! The "80" is time-tested and job-proved—for tamping, backfilling, pipe handling and other types of trench completion work. Get complete information on it *now!*

Order now for prompt delivery, clean up your back-end problems before winter sets in. The "80" is available 2 ways . . .

SEE YOUR LOCAL DISTRIBUTOR OR CONTACT FACTORY DIRECT

THE CLEVELAND TRENCHER CO. 20100 ST. CLAIR AVE. CLEVELAND 17, OHIO

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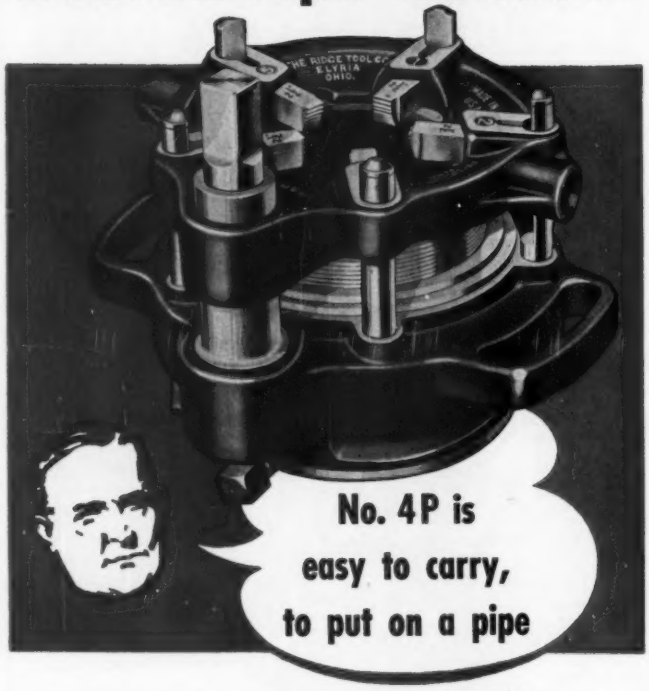
Easier to Handle this RIDGID Geared Pipe Threader



● You'll like the balanced loop handles that make it easy to swing the 4P around where you want it. Making it still more of a work-saver, mistake-proof workholder sets to size *before* you put it on pipe—only one screw to tighten, no bushings to fool with. 4 sets of 5 high-speed steel chaser dies give quick, clean threads on 2½", 3", 3½" and 4" pipe. Ratchet handle furnished—for power threading use with RIDGID Universal Drive Shaft and Power Drive. Save your muscles—buy this easier-to-handle RIDGID 4P at your Supply House.

RIDGID

★ Work-Saver Pipe Tools ★

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LETTERS

TO THE Editor

"SLOW" DOESN'T MEAN "SLOW"

I wish to express my appreciation for the fine job which you have done in your abstract of the paper "Studies on Diatomaceous Earth Filtration" published on page 85 of the September issue of Public Works. However, I should like to call your attention to a statement repeated three times in the abstract, which I feel may mislead your readers. What I have in mind is your reference to "slow" sand filters when the type of sand filter mentioned in the original article is the conventional gravity type "rapid" sand filter (see pages 475, 492 and 493 of the Journal of the American Water Works Association, July, 1951)

This is a detail which can easily escape the attention of the reader and perhaps should be overlooked; nevertheless, I thought this observation might be of interest to you.

Joseph M. Sanchis,
Sanitary Engineer,
Dep't. of Water & Power,
Los Angeles, Calif.

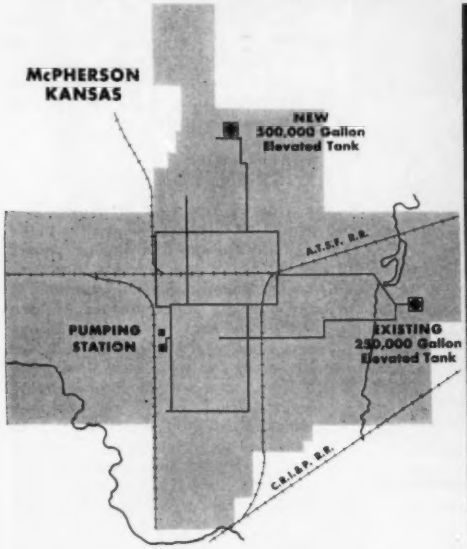
BUBBLE BUBBLE

I have just read your September issue and noted the bubble trouble at the Los Angeles activated sludge plant. Knowing what a nuisance this can be, I thought I would pass on a possible solution. S. L. Allison, Superintendent of Sewerage, Corpus Christi, and a good operator of his, seem to have the problem solved at their Oso treatment plant. They use a header with fixed nozzles to spray final effluent on the tank surface just as the sewage "rolls" from under the top edge of the aeration tank. The header runs the full length of the tank.

Joe B. Winston,
Sigler, Clark & Winston,
Consulting Engineers,
Weslaco, Texas.

(Ed. Note: Many thanks for the information. We have asked Mr. Allison for a fuller description.)

ANOTHER CITY LOOKS AHEAD
with HORTON Elevated Water Storage

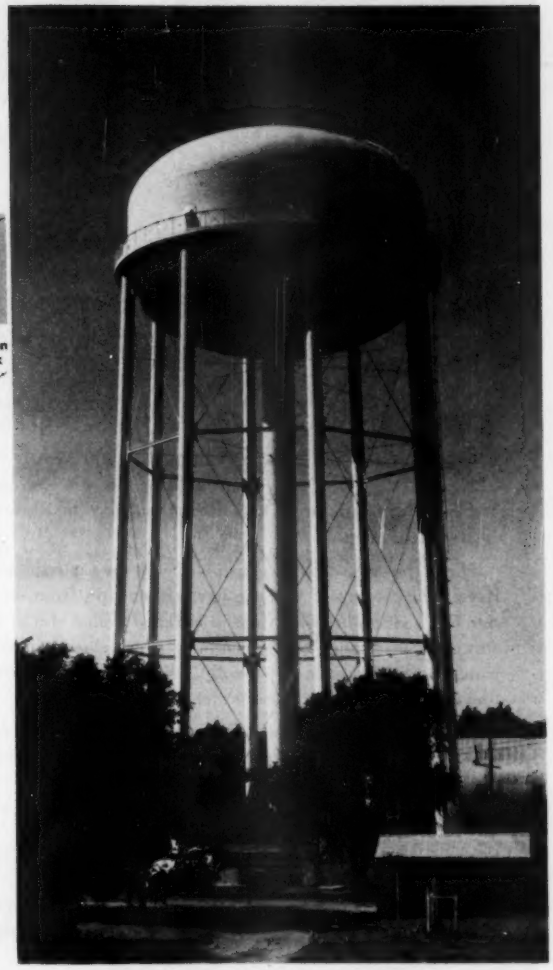


Extensive municipal improvements in McPherson, Kansas, recently included over 15,000 feet of water transmission lines and the modern 500,000-gallon Horton elevated water tank shown at the right. Both these important additions will have a favorable effect on the city's water service for many years to come.

In many instances, Horton elevated tanks have paid for themselves in a relatively short period of time by reducing pumping costs and improving customer satisfaction *throughout* the water system. Increased pressure often means increased consumption.

Horton elevated water tanks with ellipsoidal bottoms are built in capacities from 15,000 to 500,000 gallons. The radial-cone design is used for capacities from 500,000 gallons to 3,000,000 gallons.

Plan for the future — Give your city the advantage of Horton elevated storage.



This 500,000-gallon Horton tank, 98 ft. to bottom, provides gravity water pressure in the distribution mains at McPherson, Kansas. It has a 30 ft. range in head between the upper and lower water levels.

HORTON
WELDED STEEL
STORAGE TANKS

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Boston 10.....1038-201 Devonshire St.
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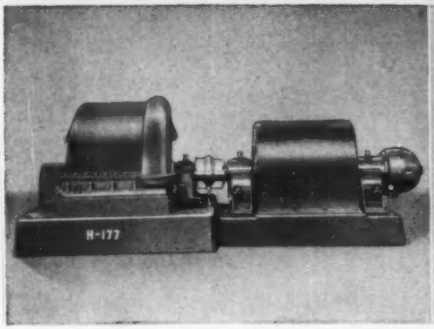
Havana.....402 Abreu Bldg.
Houston 2.....2142 National Standard Bldg.
Los Angeles 17..1508 General Petroleum Bldg.
New York 6.....3316-165 Broadway Bldg.
Philadelphia 3..1648-1700 Walnut St., Bldg.
Salt Lake City 4...539 West 17th South So.
San Francisco 4.....1525-200 Bush St.
Seattle 1.....1339 Henry Bldg.
Tulsa 3.....1641 Hunt Bldg.
Washington 6, D. C.....1120 Cafritz Bldg.

Now's the time to mail this month's Readers' Service card.

Take no chances on V-P-L



CENTRIFUGAL

One of three, Type H, 3-Stage Centrifugal Blowers in a metropolitan sewage treatment plant. Capacity 15,000 cfm. Other plants in this same city are also equipped with R-C units.

V for Volume—P for Pressure—L for Low power cost.

Those are three essentials for adequate blower performance. You're sure of all three, with Roots-Connersville Blowers and related equipment.

That's the case whether your plant calls for Centrifugal or for Rotary Positive units. You can have either type, from the exclusive R-C *dual-ability line*. Capacities range from 5 cfm to 100,000 cfm, thus permitting the selection of a size closely matched to your specific demands. Frequently, this freedom of choice saves time, cost, space, weight and power.

R-C engineers will gladly help you select the right blowers with the V-P-L needed to provide reliability and economy.

ROOTS-CONNERSVILLE BLOWER CORPORATION
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ROTARY

R-C Rotary Positive Blower in sewage treatment service in a small midwestern city. Capacity 600 cfm.

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BLOWER BUILDERS SINCE 1854
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BOOKS IN BRIEF

EASTON PLANNING

The report of planning activity for Easton, Pa., prepared by Morris Knowles, Inc., Pittsburgh, has been issued. This brings up to date the accomplishments of the Easton Area Planning Program.

IRRIGATION ENGINEERING

This is Vol. 1 of Irrigation Engineering. It covers primarily the agricultural and hydrological phases of irrigation and it treats these exceedingly well. Special attention is devoted to soil moisture, return flow, snow surveys, drainage recovery, quality of water, use of water by crops, salt balance, irrigation efficiencies and methods of applying water. What you want to know from "artesian pressures" to "weather influences" is covered. By Ivan E. Houk, consulting engineer. 521 pages; well illustrated; John Wiley & Sons, Inc., New York. $9.

NBS REPORT

The annual report of the National Bureau of Standards for 1950 summarizes the scientific investigations conducted by the Bureau. There are 113 pages, with 28 halftone illustrations. In addition to the accounts of activities, there are detailed descriptions of expecially important scientific developments. Order from the Government Printing Office, Washington 25, D. C. Misc. Pub. 200. Price 50¢.

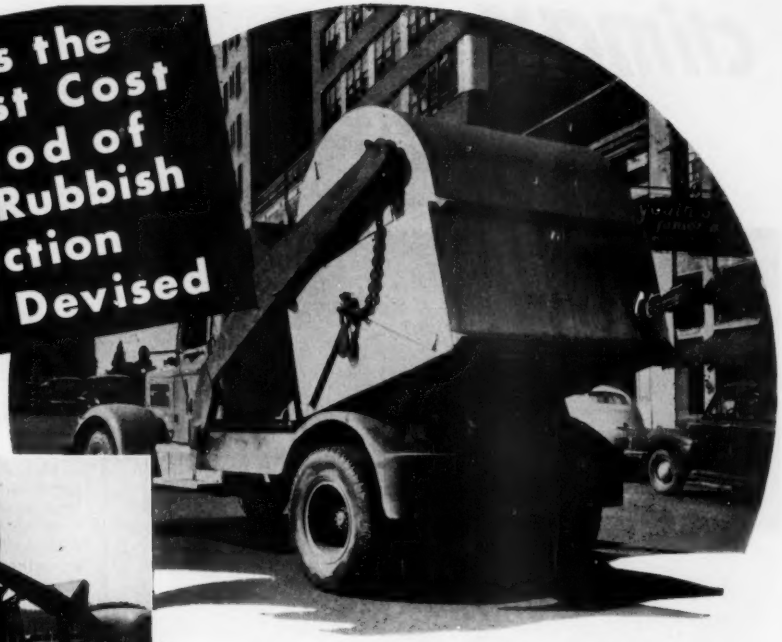
AIR POLLUTION

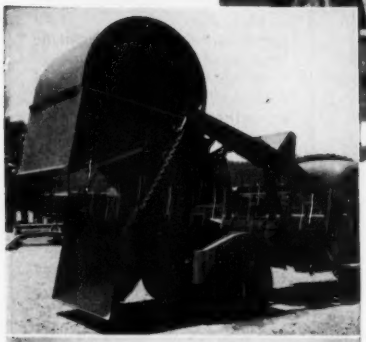
The Air Pollution Abatement Manual is being published chapter by chapter. Two chapters are now available: I- Introduction; and III Community Relations. It is intended that this manual, when complete, will include the best technical information available on the handling of pollution problems. The chapters are 25¢ each and are available from the Manufacturing Chemists' As.'n., Woodward Bldg., Washington 5, D.C.

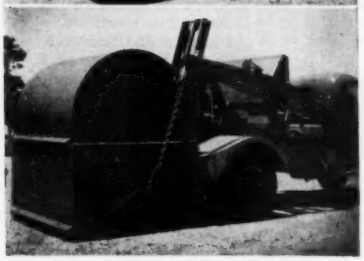
SEWAGE CHLORINATION

This is Manual of Practice No. 4 of the FSIWA and the full title is "Chlorination of Sewage and Industrial Wastes." It reviews the his-

Here is the Lowest Cost Method of Bulk Rubbish Collection Ever Devised







PICK UP, HAULING AND DUMPING operations are shown above. Large photo shows Dempster-Dumpster hauling a pre-loaded 10 cu. yd. container from downtown Nashville to sanitary fill.

You can cut your cost of rubbish collection in the trouble areas of your city in half with the Dempster-Dumpster System! We know this because it is being done in dozens of other cities. This remarkable system comprises one or more truck-mounted Dempster-Dumpsters, each with only one man, the driver, which services scores of detachable Dempster-Dumpster Containers. Containers of various designs range in size up to 12 cu. yds. (two and one-half times the capacity of the average dump truck). The Dempster-Dumpster makes scheduled calls at housing, market and business areas, schools, hospitals, etc. Each pre-loaded container is picked up, hauled to disposal area, emptied and returned. Entire operation is handled hydraulically by means of controls in truck cab.

The Dempster-Dumpster System triples man-hour efficiency . . . reduces truck investment, gas, oil, maintenance costs . . . improves "housekeeping" methods . . . reduces fire hazards . . . provides an easier, quicker, safer and more effective manner of handling bulk trash and refuse.

The cleanliness of the Dempster-Dumpster System is due to the completely closed steel containers. Trash and refuse cannot be scattered over streets and alleys by winds or scavengers. In addition, Dempster-Dumpster Containers are rat-proof and fire-proof! For complete information write today! Manufactured exclusively by Dempster Brothers, Inc.

One Dempster-Dumpster Services All Containers. . . All Designs. . . All Sizes

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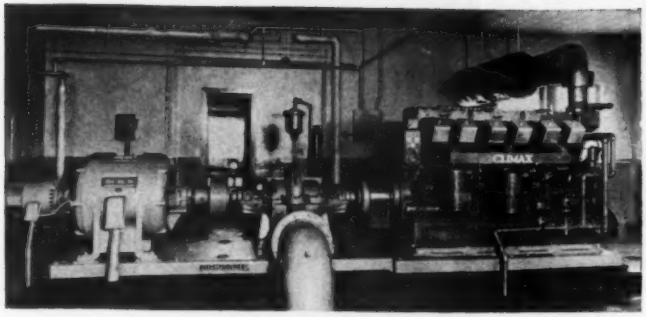
climax DEPENDABILITY



Climax Blue Streak 12 cylinder engine as standby for 5500 G.P.M. High Head Service Pump at Michigan City Water Works.

More Municipalities are Selecting Climax Engines Because of Their...

FLEXIBILITY
QUICK STARTING
LOW COST MAINTENANCE

In municipal water works plants Climax Blue Streak Engines drive generators and pumps in standby service, or furnish continuous power where natural or by-product gas is available.

Climax Engines are recommended for direct connection to individual pumps or through disconnect, free wheeling or automatic clutch couplings to motor driven pumps, where the motor is used for normal operation and the engine for emergencies.

For water works service Climax Engines are the choice because of their low upkeep expense, extra quick starting and sufficient surplus capacity to supply power for an indefinite period of time.

Service records show many installations have rendered reliable service for over 15 years.

Write for complete information and specifications on these dependable power plants. There are 4, 6, 8 and 12 cylinder engines, rated from 40 to 600 HP, operating on natural gas, Butane or gasoline. Sewage gas engines are *available* in sizes 40 to 250 HP.

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tory, development and up-to-date technique of chlorine application in all aspects of the treatment and disposal of water-borne wastes. Price: To members $1; to non-members $1.25. Federation of Sewage and Industrial Wastes Associations, 325 Illinois Bldg., Champaign, Ill.

DEW VS VISIBILITY

A 4-page report on the effect of dew on the night-time readability of six different types of standard traffic signs. Sent on request. Minnesota Mining & Mfg. Co., St. Paul 6, Minn.

LEADERS IN THE PUBLIC WORKS FIELD

Albert H. Ullrich, whose picture appears on our front cover this month, is Superintendent of Water and Sewage Treatment for the city of Austin, Texas. In this job, he is responsible to the City Manager for the operation and maintenance of the city's treatment plants and for planning plant expansions. One of his recent outstanding jobs has been his part in the development of the "Biosorption" process, which was described in our October issue. However, he very typically ascribes a large part of the credit for this work to his associates.

A graduate of the University of Texas (and, like all such, proud of it) in 1925 with the degree of MS in Chemical Engineering, Mr. Ullrich has been with the city of Austin since 1947. Before that, he was for 20 years in Fort Smith, Ark., with the Health Department, with the Water Department, and as consultant to a number of smaller water plants and industries.

He is married. His hobbies, he says, "are gardening, but mainly trying to learn something about the fields of water and sewage treatment." Being a most modest man, that is about all of the information we could get out of him. But we know, as his Texas friends and professional associates know, that he is a highly competent engineer and administrator and fully entitled to a high ranking among the leaders in his chosen field of work. We are proud to present his picture in this issue.

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NEW FACTS ON BETTER SOLIDS REDUCTION

Straight channel sewage screening and cutting with the Griductor is proving itself all over the nation. Now here is new data on:

1. Griductor intermittent cutting and shearing.
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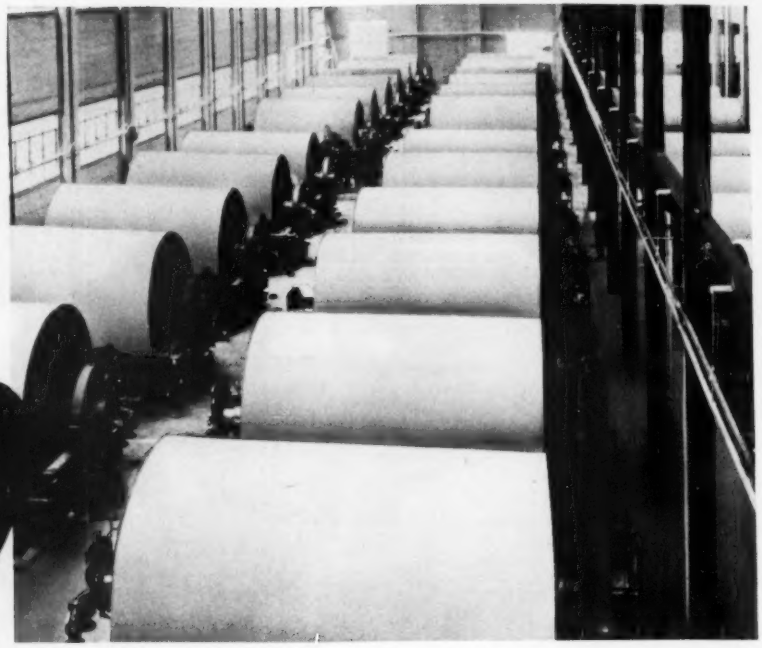
See General American for

CREATIVE FILTER ENGINEERING



Designed to do your job best!

66 Conkey Sludge Filters now installed in one plant of Chicago Sanitary District

The West-Southwest Treatment Works of the Chicago Sanitary District is the largest sewage treatment plant in the world. Here, the huge volume of industrial and residential waste from the heavily populated metropolitan area has presented sewage engineers with an unparalleled challenge. Progressively, the Chicago Sanitary District has met that challenge. Starting twenty years ago with installations of continuous vacuum filters for activated sludge, Sanitary District engineers have developed the most exacting specifications and rigid requirements for filter designs and performance ... culminating in the installation of 66 Conkey Rotary Drum Vacuum Filters for this largest single installation in the sewage field.

These Conkey units incorporate:

Polystyrene plastic cloth backing drainage plates for long cloth life and low maintenance.

Flotating cake discharge scraper.

Protective coatings for filter components.

—and other superior design and construction features.

For equivalent Conkey design and fabrication for your filter installation, write General American. Ask for bulletin No. 100 or for a consultation with one of our engineers.

Other General American Equipment:
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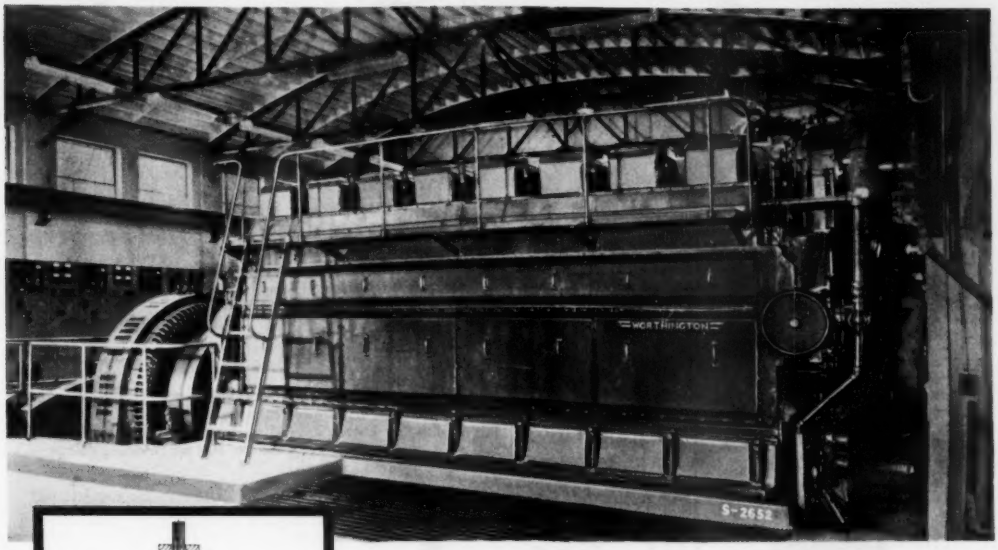

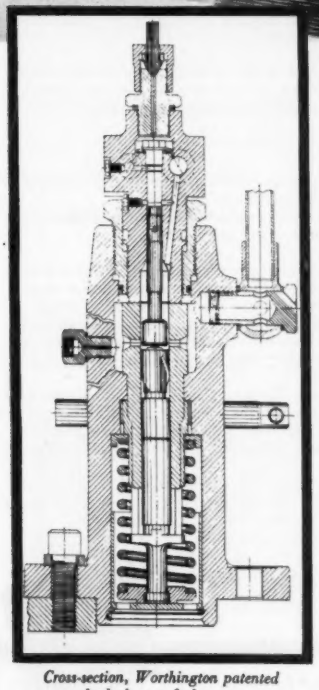

Cross-section, Worthington patented dual plunger fuel pump.

This Diesel Is Ready

FOR A CHANGE IN DIET

Right now this Worthington Diesel—one of three 1760 hp units owned by the city of Tarboro, N. C.—is operating on oil.

But they anticipate natural gas in this area, and this Diesel is ready for it. With slight changes, it can easily be converted.

Worthington's patented dual plunger pumps now completely fuel this engine with oil—producing more perfect atomization, making possible the use of a *heavier* grade of oil. Also: firing pressures are reduced, exhaust temperatures, too, and combustion is improved.

When the conversion to gas is made, the dual plunger pumps will furnish pilot oil for ignition. Conversion is made quickly and at low cost.

For any engine application, call on Worthington—an engine for any fuel: oil (crude or regular), gas or "dual fuel". Worthington's complete line of engines assures you of the most economical operation no matter what fuel you use.

Only Worthington dual fuel engines offer such exclusives as dual plunger pumps, gas micro-metering valves for each cylinder, and automatic thermal air control—all built to give optimum performance for the fuel used.

Write for Bulletin S-500-B 31 C, Worthington Pump and Machinery Corporation, Engine Division, Buffalo, New York.

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Diesel Engines, 150 to 2640 hp
Gas Engines, 190 to 2880 hp
Dual Fuel Engines, 345 to 2640 hp

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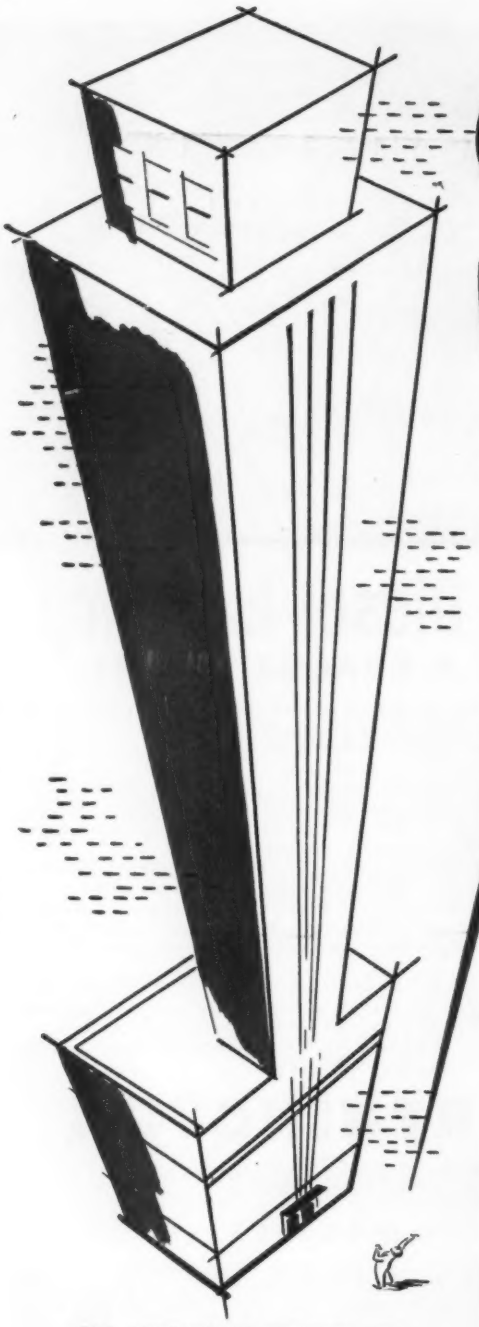

GOSH
it wasn't even here this morning

Now, w-a-i-t a minute! That's going a little too far. Maybe we do perform industrial miracles in this America of ours, but we have not gotten around to putting up skyscrapers in *one* working day—not yet anyhow. But we're doing things almost as miraculous as that.

Automobiles, radios, television sets, washing machines and so many other wonderful things are pouring off our production lines by the thousands—daily.

Never before in the history of the world have so many labor-saving, time-saving, miracle-working devices been made for the comfort and convenience of any people.

How do we do it? Easy!

We do it simply by a unique combination of qualities that make our nation the most productive of any country on earth. We do it with a system built on our solid faith and belief in the dignity of the individual.

We haven't reached a state of perfection yet. We probably never shall. But we've been getting better and better and better all the time. While we've been making all of these wonderful things, we've been working progressively shorter hours, earning more money, living better and decreasing the cost of production so that prices can go down.

Our American system is the best, the most thrilling, ever devised. With even better teamwork, the future is unlimited. If you want to help make that future, join with The Advertising Council in explaining the American economic system to your employees.

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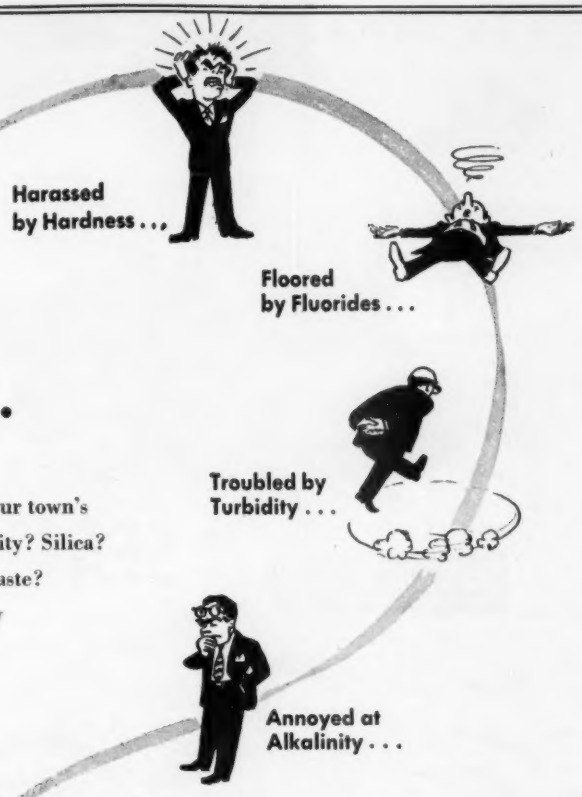
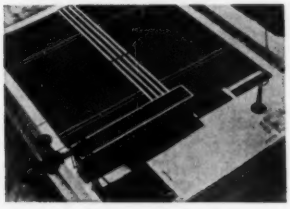
Men with WATER ON THE BRAIN . . .



Is there something wrong with your town's water supply? Hardness? Turbidity? Silica? Alkalinity? Fluorides? Color? Taste? Odor? If you are plagued by any one of them, it's a good idea to specify Permutit water conditioning equipment.

—— *should know about the* PERMUTIT PRECIPITATOR!



The Permutit Precipitator brings you a new and more efficient means for removing impurities from water. It does this by precipitation, adsorption, settling and upward filtration. Its sludge blanket is kept fresh and active at all times. The Precipitator requires less space, less time and less chemicals than previous designs of reaction and settling tanks.

Write today for full information about this economical equipment to The Permutit Company, Dept. PW 11, 330 West 42nd Street, New York 18, N. Y., or to Permutit Company of Canada, Ltd., 6975 Jeanne Mance Street, Montreal.

Water Conditioning Headquarters for Over 38 Years

PERMUTIT

The SEAMAN Self-Propelled Mixer "making ice cubes" in highway ice clearance.

Working with the SEAMAN at night to clear streets of ice in South Milwaukee.

Heavy traffic on Wisconsin Avenue, Milwaukee, Wis., was not disturbed in ice removal operation.

CLEAR YOUR STREETS OF DANGEROUS ICE

Quickly, Economically with the SEAMAN MIXER

The SEAMAN shattering heavy sheet ice at Davenport, Ia. Note close to curb operation.

The SEAMAN Self-Propelled Mixer, 7 ft. wide. Gas or Diesel powered.

The pictures tell the story. With the SEAMAN you shatter sheet ice for easy removal. There's not the slightest pavement damage. No need for traffic detours either, while the work is going on.

The SEAMAN works close to the curb too, so you can clear the entire width of the street.

In emergencies where time is limited, dangerous ruts at intersections can be quickly leveled without treating the entire area.

The SEAMAN does a top job in loosening and pulverizing hard packed snow to facilitate the work of your snow removal equipment.

And remember, during the other months the same SEAMAN will be highly profitable to you in mixing for your street and parkway construction.

Just a post-card marked "ice removal" will bring you complete operational information. And a complete description of the SEAMAN MIXER, too. Send us your request — today.

SEAMAN MOTORS, INC.

266 No. 25th ST. MILWAUKEE, WIS

HYDRAULIC CATCH BASIN CLEANER ALONE PAYS FOR VERSATILE HYDROCRANE

With big loads like this, it only takes a few passes and the Hydrocrane is off to another catch basin. And note this feature: the Hydrocrane's boom —which telescopes in and out hydraulically — is unmatched for close quarter work under low overhanging tree branches and wires.

IN considerably less than a year, actual figures* show, the Hydrocrane's hydraulic catch basin cleaner can save enough money to completely pay for the whole truck crane! For example, even in a system with as few as 2500 catch basins, the impressive savings over hand labor with this attachment alone can pay for a Hydrocrane in less than a year. And when you add the Hydrocrane's value for setting pipe, uncovering leaks or trucking, it's easy to see why this handy truck crane is tops in its field.

Operation is extremely simple. The hydraulically powered crane eases the orange-peel type bucket down into the catch basin. When it reaches bottom, the operator touches his control lever and a powerful hydraulic ram pulls the bucket lips tightly around the muck and debris. A flick of another lever and the load is hoisted out and dumped. Hand levers only — no tricky hand-foot coordination.

Users report this bucket is particularly valuable where bottles, bricks and other hard materials are dumped into the sewer, because here suction type machines simply won't work. And it's fast! Under normal working conditions the Hydrocrane has cleaned as many as 36 catch basins per day.

Get full details on this new, cost-cutting way to clean catch basins. Two Hydrocrane sizes, ¼-yd., 2-ton, ⅜-yd., 3-ton. Send coupon for details.

*we'll be happy to explain them in detail

BUCYRUS ERIE HYDROCRANE

SOUTH MILWAUKEE, WISCONSIN

BUCYRUS-ERIE HYDROCRANE DIVISION
South Milwaukee, Wisconsin

Gentlemen: ☐ Please send Hydrocrane literature.
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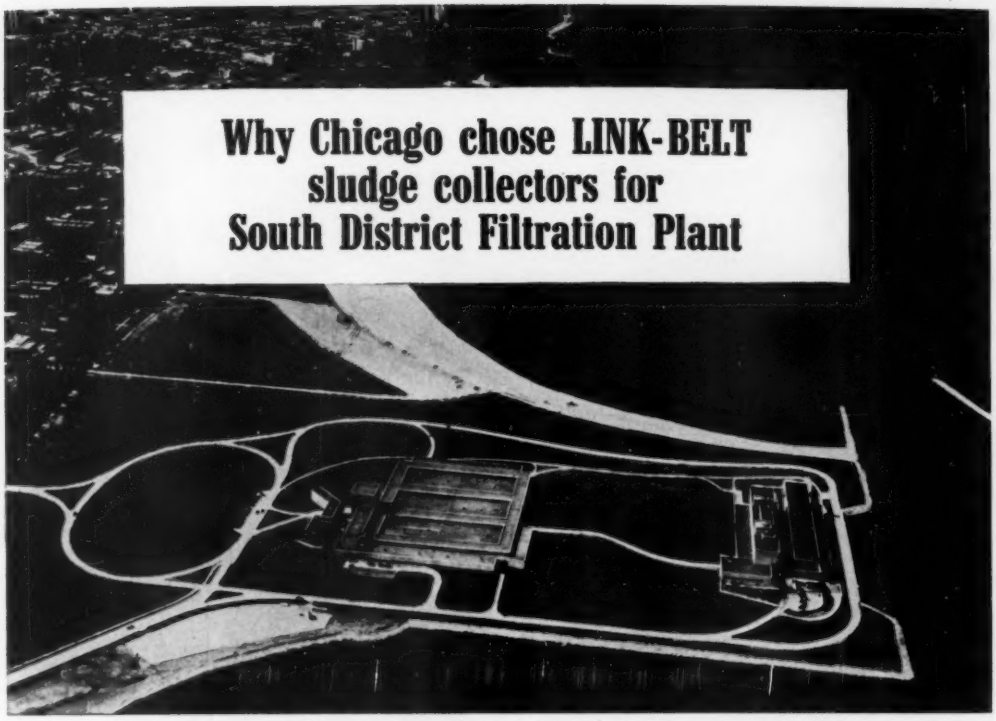
123HS1

Now's the time to mail this month's Readers' Service card.



Why Chicago chose LINK-BELT sludge collectors for South District Filtration Plant

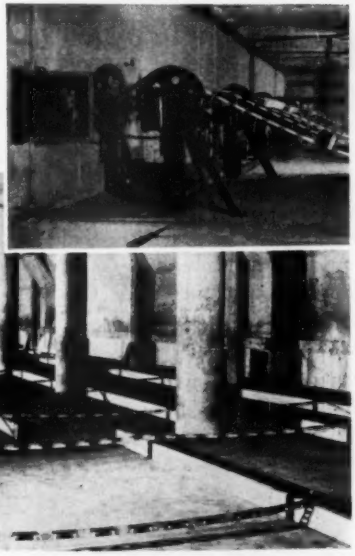
Jutting out into Lake Michigan on man-made land is Chicago's South District Plant. Peak load capacity: 650 mgd. Designed by City of Chicago Filtration Engineers in consultation with Greeley & Hansen and Alvord, Burdick & Howson.

Straightline Action provides high efficiency, greater solids concentration

When Chicago put in its first water treatment plant, Water Filtration Division engineers and their consultants selected Link-Belt Straightline Sludge Collectors. Unique double-deck basins resulted in considerable space-saving, with Straightline Collectors serving both decks. Maximum sludge collection and concentration are accomplished in the shortest time.

Straightline Collectors are part of the complete Link-Belt quality line. At the South District Plant, for example, Link-Belt provided the mixer drives and chemical-handling screw conveyors.

On small jobs as well as large, our sanitary engineers will be glad to work with your engineers, chemists and consultants — to help you get the best in collectors, screens, mixers, conveyors and allied treatment equipment.



Collectors are installed transverse to the flow and in only the first one-third of the two-level settling basins. *Above:* Upper level of settling basin, showing submerged worm gear and chain drives. Link-Belt Gearmotor drives are located in pipe gallery.

LINK-BELT

SANITARY ENGINEERING EQUIPMENT

LINK-BELT COMPANY: Chicago 9, Indianapolis 6, Philadelphia 40, Atlanta, Houston 1, Minneapolis 5, San Francisco 24, Los Angeles 33, Seattle 4, Toronto 8, Springs (South Africa). Offices in principal cities. 12,089

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PUBLIC WORKS
Magazine
NOVEMBER, 1951 VOLUME 82 • NO. 11

• *OWNED by the Utah State Road Commission, this Galion motor grader is spreading subbase material.*

SOLVING PUBLIC WORKS PROBLEMS

Laying a Double Bituminous Surface

WILLIAM T. REID,
Sup't. of Public Works,
McAlester, Okla.

FOR laying a double bituminous surface on old shale, we used the following procedure: (1) The old surface was swept clean; (2) the cleaned surface was primed with 0.3 gal. per sq. yd. of MC-1 cut-back asphalt and allowed to cure for 24 hours; (3) the surface was shot with 0.4 gal. per sq. yd. of MC-1 cut-back; (4) 40 pounds per square yard of 5/8-inch limestone chips were spread; (5) the surface was rolled one time over; (6) the surface was shot with a second application of MC-1 asphalt, 0.4 gal. per sq. yd.; (7) 30 pounds per square yard of 3/8-inch limestone chips were spread; (8) the surface was dragged with a broom drag; (9) the surface was rolled with a smooth wheel roller, 5 times over.

The following equipment was used in this work: A 600-gallon Grace trailer type distributor; a 5-ton Ferguson roller; a Grace spreader box, 10-ft.; a Model A Farmall tractor with front end loading device for loading the chips; two 1½-ton Dodge dump trucks; one drag broom made in our own shops; and one Hough rotary engine driven sweeper.

Though the MC-1 asphalt is usually recommended only for prime work, in this case it proved satisfactory.

A Special Shoe for Gutter Cleaning

R. K. SNETHEN,
City Engineer, Plainview, Tex.

WE have a large amount of new asphalt paving of the penetration type, with the result that there is considerable length of gutter that cannot be swept in the normal manner, due to the necessity of leaving as much stone and gravel on the edge of the street surface as possible. This meant cleaning the gutter by hand. To overcome this, we designed and built a special shoe to fit the bucket of our LeRoi front end loader. This shoe is made so that

the bucket is kept off the edge of the asphalt pavement, with the cutting edge of the shoe just fitting the gutter. The loader was driven along the gutter and a man rode in the bucket to push back the dirt so as to fill the bucket.

This dirt was high in caliche and was so hard and stuck so tightly to the gutter that the regular sweeper would not loosen it, even on streets that could be swept. Two men and the loader with this special shoe cleaned as much as twenty 4-yd. loads from 6,000 to 12,000 feet of gutter per day. I estimate that this device saved us 40 to 60 man days and 15 truck days last year.

● ***SOUTH HAVEN'S HD-4 Warner digger quickly paid for itself.***

Municipal Engineering Problems and Solutions

M. L. NORRIS,

Sup't., Board of Public Works, South Haven, Mich.

LAST year we used a trenching machine of the vertical ladder type extensively on water main and sewer line work. A small backhoe was used for the first time in quicksand areas for sanitary sewer construction. We found this much more economical than a dragline. All of our sewer mains and services are constructed by a permanent crew, which results in a considerable saving in cost as well as better work. Where hand work was necessary, we increased the efficiency of it about 20% by purchasing a lightweight long handled shovel with a fairly flexible handle. This was much easier to use than the standard or ordinary hardware stock shovel, and it builds up the morale of the men.

A portable auger mounted on a truck paid for itself in less than four months digging holes for power poles. This auger works on a power takeoff from the truck engine. It will dig the hole and set one pole in seven minutes with 2 men. A hole in clay formerly cost us 6 man-hours of labor.

We are casting manholes in place from concrete and savings over the use of blocks or of precast units approximate $35 per manhole.

Our most worth-while legislation was a resolution by the council to the effect that, in the future, no water mains or sewer lines will be constructed unless designed on the basis of good engineering and to take care of future needs of the areas being served.

This year we are constructing a new lake intake for the water works. This will cost $422,000 and will be completed this fall. During the summer, a storm sewer into Lake Michigan will be completed at a cost of $52,000. Other municipal work will probably be in excess of $100,000.

Hurry-Up Service for a Housing Development

C. LELAND WOOD,

City Manager, Watertown, N. Y.

THE Watertown Housing Authority awarded a contract last fall for the construction of a State Housing Project. This made it necessary to extend one of our streets several hundred feet to provide an entrance for the contractor so he could begin work; and utility lines also had to be provided for the project. The work had to be done as soon as possible, so our Water and Public Works Departments put all of their equipment to work.

Our gasoline power shovel was used for all of the heavy excavation, with the deepest cut about 4 ft. A heavy tractor-shovel was used for some of the lighter work, and for loading and unloading the 36-in. reinforced concrete pipe needed for extending an existing storm sewer. This had to be placed alongside of the street before filling operations were completed. A road grader was used to grade the subgrade and to spread the gravel base after the subgrade had been well rolled.

The Water Department trenching machine dug the trench to serve for the water main extension. Other equipment used, all of which was owned by the City of Watertown, included a number of trucks for hauling and spreading gravel for the street base. A large number of equipment units were employed in a comparatively small space during a short period of time.

Air Tools Are Most Valuable Equipment

WALTER TURNER,

Sup't. Water Dep't., Cambridge, O.

We have found air tools to be almost indispensable in connection with all kinds of trenching. We use paving breakers for cuts in brick and concrete; a lighter hammer for other hard surfaces; a spade for loosening earth in the trench; and a tamper for all places were a compacted back-fill is necessary. We also drill

horizontal holes with this equipment, for installing small service lines, using an assortment of different lengths of drills. This affords a practical means of installing services, even in rock formations.

The practice here is to lay the water main on one side of the street in the parking lane, or tree strip, as it is sometimes called. We either push or drill to the opposite side of the street. Although we are just now purchasing a small ditcher, which mounts on the rear of a Ford tractor, the air tools will continue to be our most valuable equipment.

● ***NEW YORK'S never-ending job of street maintenance was described in our October issue. Here is another view of the work.***

Extension Blade Cutter for Motor Grader

THOMAS J. FRICKE,
Consulting Engineer, Stuttgart, Ark.

WE have developed what we think is a very efficient tool for use in shaping, cleaning and maintaining the many miles of wet open ditch that we have in this area. In Stuttgart, we have some 100 miles of such open ditch—some along pavement and some along gravel or earth streets. In the past, the drainage ditches along streets having no curb and gutter were cleaned and reshaped by hand, at high cost and with low efficiency. To use ten men a day would not get the job done in an entire year and would cost about $25,000 annually.

We recently purchased a motor patrol; however, this machine could not get into the wet ditches without a pull grader to help; also, the wet bottoms of the ditches do not induce even and regular cutting of graded ditches, necessary with small slopes. The machine sinks in the wet areas and rides high in firm sections. Now we have attached a 6-ft. extension blade cutter to the end of our motor patrol blade. This is extended forward to a slight angle to the main blade and downward at an angle of some 15° to the main blade. A pipe frame supports the attachment and carries thrusts to the patrol frame.

We now set the patrol on a dry, smooth street surface where traction is ideal and where the surface is level, allowing a controlled uniform depth of cut. We can cut and shape the entire ditch section with one trip at the rate of 3 or 4 miles a day and at a saving of $22,000 a year. Now we are wondering how to keep our patrol busy the year around. We need to dress the ditches only about twice a year to keep them in excellent condition.

Grader and Shovel Pay for Themselves

PRESTON C. KING,
Town Manager, Brookbay, Me.
Formerly Ass't to Manager, Brunswick, Maine

WE have been exceptionally well pleased with our Austin-Western grader. It has permitted us to do twice as much grading and ditching as we previously were able to do, and the cost of operation has been most reasonable. The four-wheel-drive enables us to get off the improved roads, out into the rough, and still operate with satisfaction. Our grader is the 99H diesel. In the winter we use it a great deal for snow removal. It has been a great piece of equipment for us.

We have recently purchased a ½-yd. Insley shovel with backhoe attachment. Formerly we purchased our gravel from private pits at a cost of 35¢ a yard, which was made up of 15¢ a yard for the gravel in the bank and a loading cost of 20¢ a yard. We use about 20,000 cubic yards a year. With our own shovel and gravel pit, we are now getting gravel in the bank for 10¢ a yard and our loading cost is running about 13¢ a yard. In addition to this saving, we have a shovel available at all times for our use, and we intend to use it for a great deal of badly needed ditching. We feel that this shovel will pay for itself within the next five years.

In clearing the area for our gravel pit, we had some experience with chain saws. Their use saved about two weeks of time and about $100 over doing the work by hand.

● ***ONE-WAY traffic is maintained in New York during repair work.***

SEWERAGE PROJECT INCLUDES SPECIAL

TWO new sewage treatment plants and a sludge disposal plant are under construction by San Francisco. The North Point plant will provide primary treatment for a design flow of 60 million gallons of sewage per day. The Southeast plant will treat an average dry weather flow of 30 mgd, but has a capacity to handle 70 mgd during rainy periods. The sludge treatment plant, located just across Jerrold Ave., will treat the sludge from both of the new plants, as well as that from the 20 mgd Richmond-Sunset plant. The sludge from the North Point plant will be pumped through a 10-inch main 5.93 miles long to the sludge treatment plant. Filter cake from the Richmond-Sunset plant will be trucked in for final treatment.

The Southeast Plant

The Southeast plant is located on a 3-block area between Phelps and Quint Streets and Galvez St. and Jerrold Ave. The chlorinated effluent will discharge into Islais Creek and the sludge will be pumped across Jerrold Ave. to the sludge treatment plant on an adjoining site. The Southeast plant consists of the following units:

A headworks building, 65 ft. wide, 180 ft. long and 65 ft. maximum height, housing the influent control gates; two hand and mechanically cleaned bar screens; two mechanically cleaned grit chambers; the raw sewage pump sump; and two sewage lift pumps.

The sedimentation tanks are housed in two buildings, each containing two aeration-sedimentation tanks 38 ft. wide, 260 ft. long and 10 ft. deep, equipped with plate aerators and straight-line sludge collectors carrying sludge to the discharge ends of the tanks. These buildings will be of concrete, with the roof 14 ft. above the tank walkways.

The sludge control building is two stories, 30 ft. by 55 ft., housing sludge wells and sludge pumps as well as the return elutriation overflow sumps and elutriation pumps.

Courtesy McDonald, Young & Nelson, Inc., and Morrison-Knudson Co. Inc.

● ***AIR-VIEW of the new sludge treatment plant for San Francisco taken before completion of work. Southeast plant in background.***

The elutriation overflow is returned from the sludge treatment plant across Jerrold Ave.

The chlorination building is a one-story structure containing the chlorinators for pre and post chlorination, and with outside storage for carload deliveries of chlorine. The electrical substation and transformer room is a one-story building, 16 ft. by 24 ft.

The contract for the construction of this plant was awarded in Jan., 1950, to the Walsh Construction Co., Bates & Rogers Constr. Corp., and J. H. Pomeroy & Co., Inc., Joint Venture, for $2,131,118. Construction started on March 13, 1950, with 500 days allowed for completion. The plant was designed by Clyde C. Kennedy, consulting engineer of San Francisco. Soil conditions have been difficult at times. However, the headworks building was constructed on sand and in open cut, without piles. The water table was lowered below the excavation by means of four deep wells outside the corners of the structure. The lowest point of this heavy structure, designed to resist uplift, is 42 ft. below finished ground level.

SLUDGE TREATMENT PLANT

The Sludge Treatment Plant

This plant, also designed by Mr. Kennedy, will treat pumped sludges from the North Point and Southeast plants and the trucked filter cake from the Richmond-Sunset plant. Treatment will consist of thickening of raw sludge, digestion, elutriation, vacuum filtration and heat drying of filter cake to produce a dried sludge of about 8% moisture content which will be sold for a fertilizer base or soil conditioner.

There are 10 digesters, each 100 ft. in diameter and 33 ft. high, with steel floating covers. These are arranged in two groups of five each, each group consisting of 3 primary digesters and two secondary digesters. The digesters are of prestressed concrete construction. The concrete for the shells was poured in 4-ft. lifts, in plywood forms, using specially designed elephant trunks

(*Continued on page* 56)

● ***SOUTHEAST plant has normal capacity for treating 30 MGD, but can handle wet weather flow of 70 MGD. Primary treatment only is provided. Sludge is treated in special plant which also treats sludge from the 60 MGD North Point plant and the 20 MGD Richmond-Sunset plant.***

REDESIGNING A CATHODIC PROTECTION SYSTEM FOR AN ELEVATED TANK

HENRY J. GRAESER
Asst. Supt., Water Dept., Dallas, Texas
and
ED. R. WALKER
Supervisor of Water and Sewage Pumping

CATHODIC protection of steel water storage tanks is recognized as an acceptable method of surface protection, and has a satisfactory service record in many municipal and industrial applications, despite the inadequate specifications under which many systems have been purchased. Even at present, bids received on cathodic protection systems for water tanks vary widely in first cost; and close examination of the respective offerings may show that an inadequate system is being offered by the low bidder under loose general specifications. Even the most reliable firms offering this service admit that on the basis of latest research and field experience, some of the old systems need redesigning with rectifier capacities increased to provide more positive control of corrosion.

The purpose of this article will be to describe an inadequate system which was installed in a 1 MG elevated tank at Dallas, and to follow through the redesign of this cathodic protection system on the basis of research data published by E. R. Shepard and the author.[1] The design procedure will be shown in "cook book" fashion and the theoretical development of the formula will not be considered.

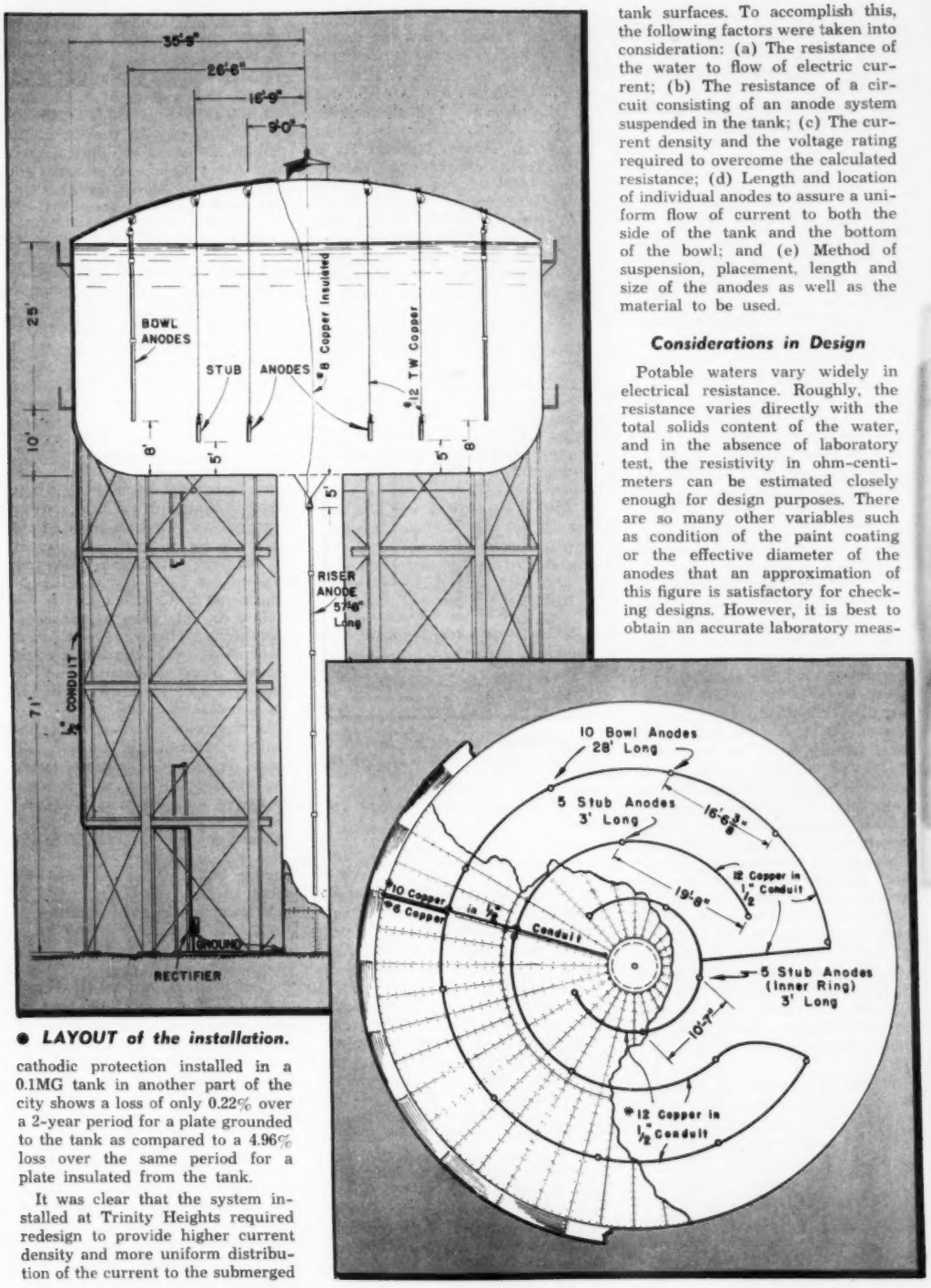
The elevated water tank in which the redesigned cathodic protection system was installed was built by Pittsburgh Des Moines Steel Company in 1935. It has a diameter of 71 feet with a total water depth in the bowl of 35 feet. The riser is 10 feet in diameter and 71 feet high. Cathodic protection was installed in lieu of repainting in 1946. This system consisted of 6 carbon anodes 2 ins. in diameter and 42 ins. in length suspended on a 21.5-ft. radius in the bowl of the tank. The riser was protected by two small platinum electrodes, each 42 ins. in length, located one third and two-thirds of the way up the riser, respectively. The bowl amperage was set at 4.25 and the riser amperage at 0.75. This gave a current density of approximately 0.4 Ma/sq. ft. in the bowl and 0.3 Ma/sq. ft. on the riser, Ma being milli-amps. That these current densities were obviously inadequate was proved as the system continued in service and no reduction in corrosion could be noted. In fairness to the installation, service conditions in this instance are uncommonly severe. The water stored in the tank comes from a deep well supply at a temperature of 115° F. It is highly mineralized as the chemical analysis in Table I will show.

In an effort to improve the effectiveness of this system in November, 1949, the 42-in. carbon anodes were replaced with six aluminum anodes 6 ft. in length. Inspection of the tank in May, 1950, indicated protection was still inadequate, and rusting of the tank was continuing. Test plates hung in the tank when the changes were made indicated that the rate of corrosion on an insulated steel plate in eleven months was 0.99%. A similar steel plate which was grounded to the tank wall showed a weight loss of 1.17%. Obviously the installation was ineffective since a properly designed cathodic protection system providing adequate current densities should completely arrest corrosion of steel surfaces. By comparison,

Table I. Analysis of Dallas Deep Well Supply

Silica (SiO_2)	25.2	ppm.	Hydroxides (OH)	0	"
Iron and Alumina as Fe_2O_3	2.6	"	Sulfate (SO_4)	264.7	"
Iron (Fe)	0.07	"	Chloride (Cl)	93.0	"
Aluminum (Al)	1.32	"	Nitrate (NO_3)	0	"
Calcium (Ca)	8.8	"	Residue on Evaporation	1033.6	"
Magnesium (Mg)	8.8	"	M. O. Alkalinity	422	"
Sodium & Potassium as Na	377.0	"	Phenol Alkalinity	16	"
Bicarbonate (HCO_3)	500.0	"	Non-carbonate Hardness	0	"
Carbonate (CO_3)	19.2	"	Calculated Hardness	27.6	"
			Fluoride (F)	1.8	"
			pH	8.4	

[1] Corrosion, vol. 6, Nov. 1950, Design of Anode Systems for Cathodic Protection of Underground & Water Submerged Metallic Surfaces.



● ***LAYOUT of the installation.***

cathodic protection installed in a 0.1MG tank in another part of the city shows a loss of only 0.22% over a 2-year period for a plate grounded to the tank as compared to a 4.96% loss over the same period for a plate insulated from the tank.

It was clear that the system installed at Trinity Heights required redesign to provide higher current density and more uniform distribution of the current to the submerged tank surfaces. To accomplish this, the following factors were taken into consideration: (a) The resistance of the water to flow of electric current; (b) The resistance of a circuit consisting of an anode system suspended in the tank; (c) The current density and the voltage rating required to overcome the calculated resistance; (d) Length and location of individual anodes to assure a uniform flow of current to both the side of the tank and the bottom of the bowl; and (e) Method of suspension, placement, length and size of the anodes as well as the material to be used.

Considerations in Design

Potable waters vary widely in electrical resistance. Roughly, the resistance varies directly with the total solids content of the water, and in the absence of laboratory test, the resistivity in ohm-centimeters can be estimated closely enough for design purposes. There are so many other variables such as condition of the paint coating or the effective diameter of the anodes that an approximation of this figure is satisfactory for checking designs. However, it is best to obtain an accurate laboratory meas-

urement of the water's resistivity.

The United States Geological Survey has equipment in all their laboratories for measuring conductivity of water in micro-mhos and this can be converted to resistivity in ohm-centimeters as follows:

Let C = Conductivity in micro mhos
ρ = Resistivity in ohm-cms
$\rho = 1{,}000{,}000 \div C$

In the absence of laboratory tests, as set forth above, resistivity can be estimated by the following formula:

Let T = Total solids by analysis in ppm
$C = 1.6T$
$\rho = 1{,}000{,}000 \div C$
$= 625{,}000 \div T$ (1)

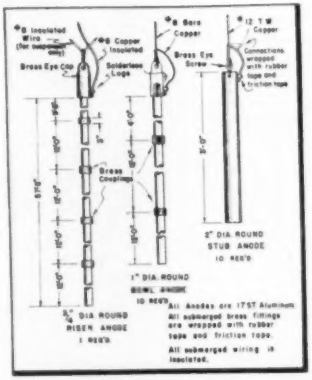
The resistivity of the water is a most important factor in the design of a cathodic protection system, as it not only dictates the size of rectifier and number of anodes required but in a large measure affects the corrosiveness of the water. Highly mineralized waters offer the least electrical resistance and yet are often not aggressive waters unless the chloride or sulfate content is high in proportion to other incrustant elements such as magnesium, calcium, or silica. Even in these cases relatively low current densities will effectively retard corrosion. The low solids, soft waters, as generally found in the eastern states, are usually extremely aggressive waters with high electrical resistance. To obtain protection against corrosion, higher current densities are required, and the high resistance dictates the use of larger and higher-voltage rectifiers and greater anode lengths.

To illustrate this condition we may consider next the calculation of the resistance of an anode system. The formula developed by E. R. Shepard for calculating the resistance of an anode buried in earth or submerged in water to a "remote" ground is as follows:

Where R = resistance in ohms
ρ = resistivity in ohm-centimeters
D = Diameter of the tank or the distance from the anode to ground in feet
A = diameter of the anode in feet

$R = .012 \log_{10} D/A$ (2)

This formula gives the resistance in ohms of one foot of anode in the media under consideration. It is based on the supposition that one anode of diameter A is suspended in the center of a tank of diameter D. These distances must be in feet since this number appears as a ratio. The displacement of an anode from center will not materially affect the resistance calculation and the resistance of the circuit will decrease almost proportionately as the length of anode is increased. Therefore, to obtain the calculated resistance of any anode system in a water tank simply divide the resistance obtained in Formula (2) above by the total length of anode


#8 Insulated Wire (for suspension only)
Brass Eye Cap
#8 Copper Insulated
Solderless Lugs
#8 Bare Copper
Brass Eye Screw
#12 T.W. Copper
Connections wrapped with rubber tape and friction tape
Brass Couplings
2" DIA. ROUND STUB ANODE 10 REQ'D.
1" DIA. ROUND BOWL ANODE 10 REQ'D.
¾" DIA. ROUND RISER ANODE 1 REQ'D.
All Anodes are 17ST Aluminum
All submerged brass fittings are wrapped with rubber tape and friction tape.
All submerged wiring is insulated.

● ***ANODE details as installed in the Dallas 1 MG water tank.***

in feet. Thus, the formula now becomes:

$R = .012 \log_{10} D/A \div L$ (3)

To this figure must be added voltage drop in the wiring system from the rectifier to the anodes. Calculations of the riser anode resistance must be made separately since the figure D is considerably reduced.

These calculations will give us a theoretical resistance. This result may be altered by the condition of any remaining paint coating on the tank walls; and if aluminum anodes have been in service for some time reduction of their original diameter will further increase the resistance. If we are checking the performance of an existing system we can obtain the actual resistance of the system by the voltage and amperage output of the rectifier. Most companies furnish a voltmeter and ammeter mounted on the panel of the rectifier, and taking these readings and applying Ohm's Law ($E = IR$) the actual resistance of the circuit can be obtained. This resistance figure will include losses in the line and paint coating loss, as well as resistance due to a rheostat which may be present in the circuit to control or adjust amperage. All of these must be taken into consideration when checking the system design by the formula.

Current Density Requirements

Since we know or can calculate the resistance, we must determine if the current applied is adequate to provide protection against corrosion. Protective current is usually expressed in milli-amps per sq. ft. of water submerged surface. A milli-amp is one-one thousandths of an ampere. Thus, 10 amps or 10,000 milli-amps applied to a tank which has 10,000 square feet submerged area would provide a current density of 1.0 milli-amp/sq.ft. This is assuming uniform current distribution to all surfaces of the tank. As to what current density is required to achieve protection, we enter a field of pure estimate. The amount of current density required depends upon the corrosiveness of the particular water in question. Also, an adequate current density is not necessarily that required to maintain bright unpainted steel in that condition.

In mineralized waters, the application of protective current will cause deposition of minerals to the tank surfaces which will increase resistance and offer increased protection. In the case of waters of low mineral content, the rate of corrosion will gradually decrease as a coating builds up on the bare surfaces. In both cases, application of relatively high current densities in the initial stages of operation of a cathodic protection system will be desirable to hasten this "conditioning" of the tank surfaces. However, if the tank has a good paint coating, care should be taken in applying this initial current. If the paint coating is recent, conditioning should be omitted entirely, as excessive current densities will blister the paint. Actually on bare metal tanks, or tanks which have lost most of their original paint, no set figure can be given as to current density required for normal operation, but it is considered desirable to be liberal with rectifier capacity and provide for current densities up to 2.5 ma/sq. ft. as a basic requirement. The additional rectifier capacity will cost

approximately a hundred dollars more, which, compared to total cost is small, and adequate capacity will be available to care for gradual deterioration of any remaining paint coating on the tank. Operating current density can vary from 0.5 ma/sq. ft. to 1.0 ma/sq. ft., after the initial conditioning period referred to above.

The best method of determining proper current density is frequent inspection of the tank interiors supplemented by liberal dispersion in the tank of insulated test plates with duplicate plates bonded to the tank wall. The test plates should be of the same type of metal, preferably cut from the same piece as the tank, and should be accurately weighed before installation in the tank and weighed after careful cleaning upon removal at regular periods. Weight tests should be made at least annually and the same plates reinstalled in the tank, with bonded plates again bonded and insulated plates again insulated. It is essential that plates be returned to the same points at which they were originally installed in order that reduced protection at any point will be detected over a period of time.

If the test plates bonded to the tank wall show an undesirable weight loss when compared to the insulated control plate, current densities should be increased, keeping in mind the warning above regarding paint coatings. If adequate protection is being obtained in one test location and inadequate protection in another, it may be necessary to change the location, or increase the number of anodes to provide more uniform current densities. As has been mentioned, the location and number of anodes will affect both circuit resistance, and uniformity of current distribution. It is necessary to balance these requirements; however, the latter is the dominant consideration. Potential drop measurements against the tank wall at selected points to obtain a potential gradient on a representative profile of the water submerged surface of the tank is desirable to determine if these requirements have been met. However, potential gradients do not prove that current densities or protection is adequate.

Anode Configuration

The general pattern considered advisable, as discussed in reference (1), is as follows: Use of at least three anodes, symmetrically placed, is considered the minimum desirable except where extremely low resistance water is present. Generally, the distance from the anode to the wall and bottom should be about equal, and the radial distance from center of the anode to the wall, approximately one-half the distance between adjacent anodes. Following these general requirements, the resistance of different configurations can be calculated. It should also be noted that the current requirements for bowl and riser of the tank should be computed separately as it will generally be advisable to feed the anodes in the bowl and riser through separate circuits. This is due to the large difference in diameters, resulting in a lower resistance of the riser electrode. If this anode were included in the bowl circuit, excessive current densities would result on the riser. The pattern adopted for the 1MG tank at Dallas, which we designate as our Trinity Heights tank, is shown herewith. Also, use of stub anodes over tank bottoms are necessary as the radius of protection below anodes is limited. For placement of these anodes, the same general rule for spacing can be followed as to lateral displacement; however, the distance above the tank floor should be from 4 to 6 feet.

Design Calculations in 1MG Tank

To compute the resistance of the anodes to the tank wall, formula (1) previously referred to was applied to obtain the resistivity of the water. By chemical analysis, the water supplying this area of Dallas has a total solids content of 1033.6 ppm.

The resistivity of the water can be estimated as follows:

$$\rho = \frac{625{,}000}{1033} = 605 \text{ ohm-cm.}$$

The water was found by test to have an actual resistivity of 570 ohm-cm. (The error in the formula will be found to reduce as the total solids decrease.) For the purpose of this design, we shall use the measured resistivity of the water in order that a more accurate check of design criteria against actual operating results can be obtained.

Let us now follow through each step of the calculations in design of the new system installed in this tank:

Tank dimensions: Diameter of bowl 71 ft.; diameter of riser 10 ft.; total height 106 ft.; total surface water submerged area in tank bowl 10,690 sq. ft.; and total surface area of riser 2,230 sq. ft.

Current requirements at 2.5 milliamps/sq. ft.:

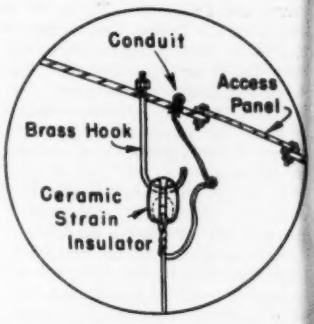
Bowl amperage = total surface area x current density in ma/sq. ft. ÷ 1000.

I = 10,690 x 2.5 ÷ 1000 = 26.7 amps.

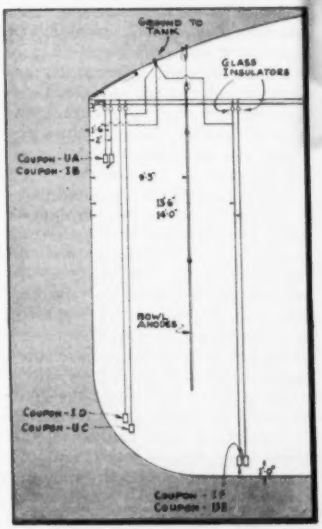
Riser amperage = total area riser x current density in ma/sq. ft ÷ 1000 = 2,230 x 2.5 ÷ 1000 = 5.5 amps.

Installation Data: 175-T Aluminum rods placed as follows: ten 1″ diameter electrodes on 26′ 9″ radius, 28′ long, suspended 8′ above tank bottom; five 2″ diameter electrodes on 16′ 9″ radius, 3′ long, suspended 5′ above bottom of tank; five 2″ diameter electrodes on 9′ 0″ radius, 3′ long, 5′ above bottom of tank; and one ¾″ riser electrode 57′ 8″ long in center of riser, 8′ 4″ from bottom of riser.

(Continued on page 74)



● ***TYPICAL anode suspension.***



● ***TEST coupons in tank bowl.***

Pavement Design for ROADS and AIRFIELDS

DESPITE many efforts to do so, no completely logical method has been evolved for designing pavements for roads and airfields. It is doubtful, in fact, if an ideal solution is possible, though two methods, the CBR and the shear strength, are valuable. These and other principal methods now being used have been critically reviewed and assessed in Road Research Technical Paper No. 20, by E. H. Davis of the British Department of Scientific and Industrial Research. The following data are abstracted from this paper by permission.

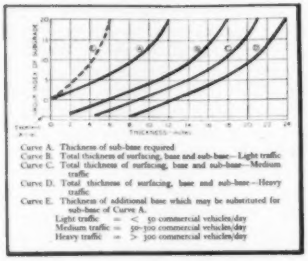
Even though existing design methods are numerous and diverse, they can be classified into four distinct groups:

Group A includes the empirical methods using soil classification tests. In this group, the thickness of construction is determined from past experience of the thickness required for similar wheel loads and soils giving similar results in such classification tests as particle-size analysis and the liquid and plastic limit tests.

Group B are the empirical methods which use a soil strength test. The test is usually a penetration or bearing test and is frequently applicable only to its associated design method. Past experience with soils of similar strength values enables the necessary thickness of construction to be assessed.

Group C methods are based partly on theory and partly on experience. The strength or stress/strain properties of the subgrade soil and sometimes of the base material are determined by shear or bearing tests and the results are employed in a simplified or modified theory which has been found to have some experimental justification.

Group D are the wholly theoretical methods. These are intended to be based on a valid analysis of the stresses and strains throughout the pavement and subgrade and the true strength and stress/strain characteristics of the various materials. This is an ideal that may never be quite reached.



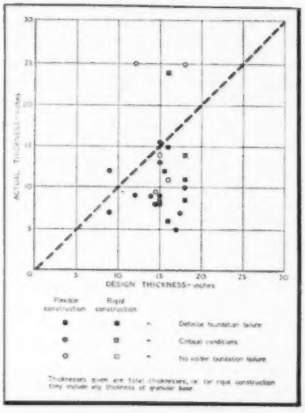
● ***TENTATIVE design curves of Highway Research Board, showing required thickness.***

Using Soil Classification Tests

The argument on which methods in Group A are based on are: Provided the base and subbase are adequately compacted, the major factor in determining thickness of construction is the strength of the subgrade. This strength is dependent on (1) the moisture content of the soil; (2) dry density of the soil; (3) the soil type; and (4) degree of remolding of the soil, which is appreciable only with clays. The moisture content and dry density are largely dependent on the soil type when compaction requirements and climatic conditions remain fairly constant. Therefore, if the effect of remolding is neglected, the strength of the subgrade and hence the thickness of construction may be considered as mainly dependent on the soil type.

A typical design method in this group is that of the Highway Research Board. The revised BPR classification of soils uses an empirical value called the group index, which is claimed to be an inverse measure of the thickness of subbase required; but the thickness of base and surfacing is varied according to the weight and volume of commercial traffic. The higher the group index, the lower its strength and the greater the thickness of subbase required.

The formula for the group index is as follows: GI= 0.2a + 0.005ac + 0.10 bd where a = that portion of the percentage of subgrade soil passing No. 200 sieve which is greater than 35 and not more than 75, expressed as a positive whole number 0 to 40; b = that portion of subgrade soil passing No. 200 sieve which is greater than 15 and does not exceed 55, expressed as a whole number 0 to 40; C = that



● ***ACTUAL thickness plotted against design thickness for group index design method.***

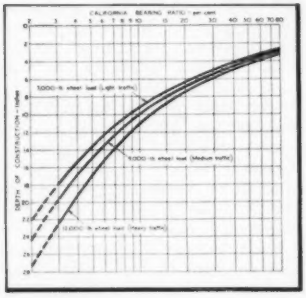
portion of the numerical liquid limit greater than 40% and not exceeding 60%, expressed as a positive whole number 0 to 20; and d = that portion of the numerical plasticity index greater than 10% and not exceeding 30%, expressed as a positive whole number 0 to 20.

Tentative design curves suggested by Steele are shown in Fig. 1. These curves give a thickness of subbase which varies only with the group index, except that a well-graded gravel subgrade, A-1-a, is considered to be stronger than any other soil having a zero group index. The design curves are based on the following: (1) compaction of subgrades to be not less than 95% AASHO dry density, and of subbase and base not less than 100%; (2) drainage to be sufficient to

keep the water table 3 or 4 ft. below the road surface.

This method has been tested by application to existing roads by the Road Research Laboratory, though the requirements as to compaction and drainage given above could not be verified in every case. These results are plotted in Fig. 2. It will be seen that, though failure is predicted at nearly all the sites where failure actually occurred, several of the points are on the wrong side of the line. Thus the method appears to provide only an approximate estimate of the thickness of construction required.

The Civil Aeronautics Administration uses a soil classification somewhat similar to that used by the BPR, though more complicated. Soil is given a strength symbol varying according to the likelihood of severe frosts and the type of site drainage. Empirical curves relate the thickness of subbase to wheel load for each strength symbol; different curves are provided for rigid and flexible pavements. These



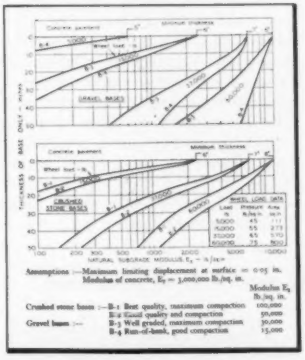
● ***DESIGN curves for flexible roads by the CBR method.***

curves apply only to aircraft wheel loads. The design method includes various specifications in regard to compaction of subgrade and subbase, the particle size distribution of the subbase and base material and reinforcement in a concrete pavement.

Methods Using a Soil Strength Test

Methods in group B make an entirely empirical approach. They select an arbitrary strength test which is considered to stress the subgrade in a similar manner to an actual wheel load. The thickness of pavement is then determined on the basis of experience with the thickness required on top of subgrades of similar strength in the past.

Such tests may include a plate bearing test directly on the surface of the subgrade which will cause stresses in the soil of similar magnitude and distribution to these caused by an actual wheel load when it acts through a pavement. Other methods employ a small-scale bearing test or, as in the California bearing ratio method, a penetration test. This measures the load required to cause a plunger of standard size to penetrate the material at a standard rate. The test may be made on material in place, but is more usually performed in the laboratory on material confined in a layer 5 ins. deep in a heavy cylindrical mold 6 ins. in internal diameter. The specimen in the mold is usually soaked before making the penetration test. This is a design precaution against severe moisture conditions in the subgrade after construction. The penetration of a 3-sq. in. plunger forced into the specimen at the rate of 0.05 in. per minute gives a load penetration curve. This is compared to a standard curve for crushed rock and the California Bearing Ratio—the CBR—is the load required to produce a specific penetration, usually 0.10 in., expressed as a percentage of the load derived from the standard curve for the same penetration. The



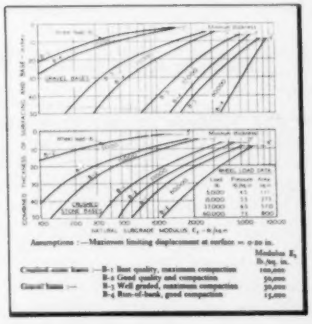
● ***FLEXIBLE road design by Burmister 2-layer method.***

Corps of Engineers interprets the results obtained in a slightly different way.

The relation between the CBR and the thickness of construction required is shown in Fig. 3. Where more than one foundation material is available, the equivalent costs of using each can be determined. For instance, with a wheel load of 12,000 lbs., and a sand subgrade with a CBR ratio of 20%, a total depth of about 8 ins. would be required and this could be made up from suitable materials at hand. With the same loading and a sandy clay subgrade, where CBR = 8%, a total depth of 13 ins. would be needed. If sand subbase material, CBR = 20%; silty sand subbase material, CBR = 15%; and well graded gravel base material, CBR = 80% are available, these may be used in the most economical combinations.

The CBR method was devised for the design of flexible pavements and it is generally used for this purpose. It is sometimes used to determine the total thickness of concrete pavement and granular base; in this case it is probably somewhat conservative. Using unsoaked specimens, the Road Research Laboratory has applied the CBR method to flexible roads having defects. These investigations show that this method provides a fairly accurate estimate of the thickness required in that failure was always predicted where failure had occurred and nowhere that failure had not occurred. Furthermore, where the pavement condition was critical, though no failure had actually occurred, the CBR method indicated the safety margin to be very small.

When designing new roads, the chief difficulty with the CBR method, or with any method, for that matter, is to decide under what conditions of moisture and dry density to test the specimens of the subgrade in order to allow for conditions subsequent to construction. As already stated, the precaution



● ***FLEXIBLE road design by Burmister 3-layer method.***

is usually followed in the USA of soaking the specimen for four days under the appropriate surcharge before making the penetration test. If the soaking is complete, this precaution produces a condition in the specimen about equivalent to that produced in the subgrade by a water table at the surface of the subgrade. It is commonly considered that this is unnecessarily severe and that the use of the soaking procedure is liable to produce an over-conservative design.

CBR Modifications

An interesting modification of the CBR method has been suggested in Australia. A standard wheel load of 5,000 pounds is considered and tentative design curves are given for different numbers of thousands of repetitions of this load. This number of repetitions is obtained from surveys of traffic flow, with allowance for anticipated traffic increase and modified by factors for (1) the desired life of the pavement; (2) the width of the pavement; and (3) the frequency with which abnormally high moisture conditions might exist in the subgrade as determined from climatic conditions. CBR values for these curves are determined from soaked specimens. If wheel loads greater than 5,000 pounds are anticipated, the number of repetitions is increased. For example, one 9,000-lb. wheel load is considered equivalent to 16 standard-load repetitions.

A method similar to the CBR has been developed by the North Dakota State Highway Department. This uses a cone penetration apparatus. The test is conducted in the field by measuring the penetration when the cone, which has a total angle of 15° 30′, has been loaded with a 10-lb. weight for 1 minute and again with 20, 40 and 80-lb. loads. From these measurements, an average cone-bearing value in pounds per square inch is calculated by dividing the cross sectional area of the cone at the surface of the soil by the applied load. In developing the design data, tests were made on subgrades under roads that had failed and those that had not failed. The equation of the curve is $T = 65.7 \div B^{0.388}$, where T is the thickness of construction in inches and B is the cone bearing value in lb./sq. in. The formula is considered to apply to an average heavy traffic wheel load of about 5,000 lbs., with a contact pressure of 70 lbs./sq. in., and the method includes means of converting the thickness of construction given by the formula to a thickness for other wheel loads and contact pressures.

The Bureau of Yards and Docks of the Department of the Navy and the Highway Research Board Committee on Flexible Pavements recommended methods employing the plate-bearing test. Trial sections of pavement of the estimated needed thickness are constructed and the results of plate-bearing tests on top of these trial sections are employed to determine the actual thickness required. The Canadian Department of Transport has studied the stability of existing airfields in Canada, using repeated plate-bearing tests, correlated with CBR tests made in place, and has evolved a complicated method of design based on the load on a plate 30 ins. in diameter, after ten repetitions of load, required to cause 0.5 inch deformation.

Methods Based Partly on Theory and Partly on Experience

The methods in this group, in order to avoid the difficulty of analyzing the true stress/strain characteristics of the soil and the true distribution of stress through the layers under a wheel load, make certain assumptions and neglect some factors, thus producing a simplified theory. It is apparent that the assumptions involved in any of the mthods in this group must be proved reasonable by experience. Soil behaves elastically to a limited extent only. Therefore methods based on the Boussinesq elastic theory will give only an approximation of the true stresses and deformations. For instance the approximate modulus of elasticity for any specific soil varies with moisture content, dry density and stress conditions, and may be anything from under 1,000 to 50,000 lbs. per sq. in.

A design method proposed by Glossop and Golder of the British Institution of Civil Engineers makes use of the Boussinesq theory of the distribution of stress. This method assumes the pavement and subgrade to form one homogenous elastic solid, and is applicable only to soils having zero or negligible angles of shearing resistance, that is to soils whose shearing resistance arises only from their cohesive properties and is independent of the applied load. The only soils in this category are clays. A preliminary survey of the site and a control survey are made in which boreholes 3 ins. in diameter are sunk about 4 ft. below pavement level and specimens for measuring the unconfined compressive strength are taken at 6-in. intervals in these boreholes. On the basis of tests on airfield runways that had and had not failed, the authors found that the curve of maximum vertical stress divided by π differentiated between failure and stability. Other investigations indicate that the curve for maximum shear stress is a more reliable indicator. Investigations by the Road Research Laboratory show this method was not quite as satisfactory as the CBR method, though it will give a moderately reliable total required thickness for both rigid and flexible pavements for wheel loads of 5,000 to 30,000 lbs. and for clays having shear strength between 3 and 15 lbs. per sq. in.

Design based on Westergaard's analysis is included in this group. His formulas provide a method of calculating the stresses within a given thickness of slab. Sufficient reinforcement is not usually incorporated into concrete road or runway slabs to provide any appreciable increase in strength, and the function of such reinforcement is considered to be the control of cracking. Westergaard's formulas are complicated and will not be given here (though they are discussed quite fully in the original report); and the same is generally true of Golder's method, that recommended by V. R. Smith, and the procedure of the Kansas Highway Department.

Methods Based on Analysis of Stresses and Strains

Because no method of design has yet been devised that has a sound theoretical basis throughout, this group of methods is more of an ideal than a reality. At present, the best empirical methods give more re-

(Continued on page 69)

The World's Largest MUNICIPAL REFUSE COLLECTION SYSTEM

HENRY LIEBMAN,
Director of Operations
New York Dept. of Sanitation

THE Department of Sanitation of the City of New York operates the world's largest municipal refuse collecting system. It utilizes about one-half of its 13,000 employees, 4,000 pieces of motorized equipment and a $55,000,000 annual budget for the ever recurring task of collecting the refuse from the eight million residents of the city and about two and one-half million daily transients. This output of refuse, exclusive of trade waste, reaches the staggering sum of 4,000,000 tons, corresponding in volume to about 22,000,000 cubic yards annually. Trade waste which amounts to about 1,500,000 tons yearly, including 500,000 tons of fats and swill taken to hog farms and rendering plants, is removed by licensed collectors.

Regulations have been promulgated by the City to establish what is to be handled by municipal forces and what is to be handled privately. The basis of this differentiation is that removal of trade waste is considered a legitimate expense of conducting a business and must be borne by the enterprise itself. Paraphrased extracts from the regulations now in force defining three types of refuse and specifying to whom service will be rendered are as follows:

Ashes is that waste material or residue left over from burning fuel in stoves, furnaces and the like.

Garbage is animal and vegetable wastes from the preparation, decay, dealing in, or the storage of meats, fish, fowl and other food products.

Rubbish consists of such waste materials other than garbage or ashes which attends the use or occupancy of buildings or premises, such as paper, straw, rags, bottles, old clothes and materials of similar character.

Residential buildings are single and two-family solely residential structures and multi-story buildings occupied solely for residential purposes above the second story.

Public Buildings are buildings used and maintained by the City of New York or the State of New York.

"Special Use Buildings" are buildings that are exempt from real estate taxation by the City of New York, for example, charitable institutions.

The section of the regulations on collection service outlines the service that the Department will render, generally, as follows:

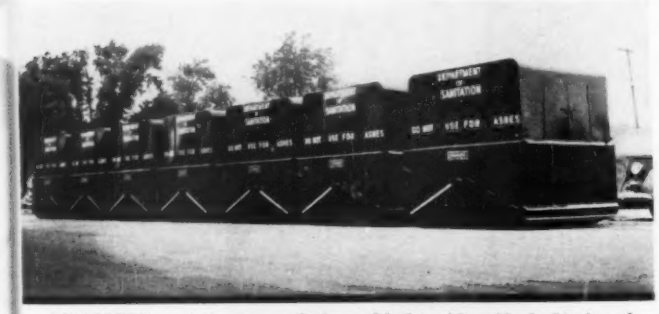
The Department will collect ashes, rubbish and garbage from "Residential Buildings", "Public Buildings" and "Special Use Buildings".

The Department will collect garbage only, unmixed, from any and every building but will not collect garbage mixed with ashes or rubbish, or ashes and rubbish, or any other refuse from other than "Residential", "Public" or "Special Use Buildings".

Trade waste collectors are licensed by the City to furnish private collection service. They are required to pay an annual fee and in addition twenty cents a cubic yard for all waste material brought to a municipal disposal point. In 1950, $750,000 was collected. Approximately 800 permittees of the Class I type, which includes garbage and rubbish removers, operate daily.

The City of New York is furnishing, at the present time, daily service to about 55% of the city and tri-weekly service to the balance. In beach and certain congested areas, collections are augmented in

the summer by Sunday collections. This frequency rate surpasses any other large city and is made necessary because of many reasons. One of the primary causes is the housing shortage. The doubling and tripling up of families has resulted in overtaxation of the limited storage space within many of the older buildings. In the Harlem area, for example, there are approximately 25,000 multi-dwelling apartment buildings which were built to accommodate one family per apartment, but which are now occupied by one family per room. There is not enough storage space in these buildings to hold more than a day's output of garbage and rubbish. The requirements of good sanitation, odor control, rat control and disease prevention make it imperative to remove this highly putrescible material daily from the densely populated areas of the city.



● ***DEMPSTER containers are being added to New York City's refuse collection equipment. Here are 7 of 88 received.***

Household Handling

The manner of the householder's presentation of refuse for collection is outlined in the regulations. These were drawn to assure a sightly appearance and sanitary nuisance-free conditions. For example, the receptacles are required to be fabricated from metal, of leak-proof construction and to be fitted with tight covers. Their volume is limited to two cubic feet and the weight of can and contents must not exceed one hundred pounds. This type of holder prevents scattering of its contents by wind or by animals, such as dogs, cats or rats, and denies access to the refuse to flies and other disease-breeding insects; liquids cannot ooze out of the bottom onto the streets or pavements creating a nuisance. To provide for possible interruption of service due to snowstorms or holidays, each location must have sufficient receptacles for a sixty-hour period. Filled cans must be placed at the front house lines for collection and cans must be taken in as soon as empty. At present the only separation enforced is that of not mixing ashes and other refuse. Ashes must be placed out separately. There is no limitation on the number of receptacles that may be placed out for collection.

In order to secure public cooperation in complying with these regulations, a constant educational campaign is maintained through press releases, radio, television and clean-up drives by the Department's Public Relations Adviser John S. Wagner and his staff.

Organization for Collection

The highly complicated task of collecting the tremendous output of refuse, quickly and expeditiously, required the development of an organization geared to perform its duties with little lost motion. Citizens of New York are quite sensitive about their collections and do not hesitate to complain if any slip-up in schedules occur. Responsibility for collection service rests in the Bureau of Street Cleaning and Waste Collection of the Department of Sanitation. Its organizational setup resembles that of a military organization. The head of the Bureau has his special and general staffs and transmits his instructions through the Chief of Staff. The City is divided into eight borough commands headed by Borough Superintendents with their individual staffs of Assistant Borough Superintendents, messengers, clerks and drivers. Two borough command headquarters are located in Queens, two in Manhattan, two in Brooklyn, one in Staten Island and one in the Bronx. Borough commands are further divided into a total of fifty-seven districts each headed by a District Superintendent. District headquarters are located, in the main, at one of the district garages. All headquarters are connected by a teletype system with the Main Office for rapid dissemination of orders and directives. The districts are sub-divided into sections averaging about four per district, totaling two hundred thirty-four sections, each of which is under the control of a Section Foreman. Districts vary in size due to many factors, principally topographical features, population, streets and character of the district. Districts average about 150,000 persons each but vary from 50,000 to 200,000.

Periodically, districts are restudied and their boundaries realigned to correct unbalance in work loads arising from shifts or increases in population and changes in the character of the neighborhood; and to adjust the districts to increased mechanization of operations and the availability of new garages and disposal facilities. In addition to the district's collection problems, which are emphasized in this article, the problems involved in cleaning streets and snow removal are taken into consideration when laying out district boundary lines.

Approximately 6,000 men and 1,500 trucks are employed daily in collecting refuse. This number is constantly adjusted to meet the demand. Crews work on an eight-hour day with one hour lunch time, six days a week. They have been granted six paid holidays in addition to being granted time off for religious and patriotic duties. Usually the collection crews work out of the garages as a unit but during peak periods the crew is augmented with men taken from the sweeping forces.

Refuse Volume

Both the route and gang system of collection are employed. Under the gang system, the Foreman starts out with all his trucks to clean up a definite area. At the starting point he outlines the work for each unit and maintains a constant and close contact with them during the day making whatever shifts are necessary to meet the demand. This system has the benefit of close supervision and finds its

• ***ESCALATOR compactor mechanical loading unit, 16-yd. City Tank body on International truck chassis.***

best application in fairly congested districts. In the less densely populated and sprawling districts the gang system is either supplemented or displaced by the route system. Under the route system the crew is given a definite route to service and operate pretty much on their own. At intervals during the day they are checked on by the Foreman or the District Superintendent. The close supervision of the gang system is not possible under the route system.

Refuse output varies during the week; Monday is the highest day, Thursday usually the lowest. Table 1 shows collections for a typical week, in Manhattan and city-wide.

The quantity of refuse varies throughout the year from month to month, as shown in Table 2 for the year 1950.

The higher monthly tonnage in the winter is caused mainly by increased ash output. Density of the mixture of garbage and rubbish varies from 250 pounds per cubic yard in winter to 300 pounds per cubic yard in summer. Ashes range from 800 to 1,200 pounds per cubic yard. The mixture of ashes, garbage and rubbish averages about 500 pounds per cubic yard. Incinerator residue weighs dry 600 to 800 pounds per cubic yard; wet 1,000 to 1,200 pounds per cubic yard.

Organization and Records

With the ever fluctuating output, the Borough Superintendents must exercise their experience and judgment in assigning the proper number of truck shifts to each district each week. Their decisions are based on the experience of corresponding weeks in previous years adjusted to anticipated conditions. For example, the occurrence of a holiday, the weather, the state of the salvage market and economic conditions are among the many factors which must be included in their calculations. In order that data are available for arriving at the proper estimate of the situation, extensive records are kept, including daily blotters; carting records; load tickets of each truck; daily, weekly and yearly collection reports; summaries; and tabulations. Production is recorded by weight. At the disposal points which have scales, scale weights are reported. At those locations without scales, assigned weights based on thousands of tests are used. It is planned to equip all locations with recording scales.

TABLE 1

Typical Volumes of Refuse

Day	Manhattan Tons	City-Wide Tons
Sunday, 4/22/51	180	518
Monday, 4/23/51	3,000	11,770
Tuesday, 4/24/51	2,350	10,340
Wednesday, 4/25/51	1,130	9,060
Thursday, 4/26/51	1,110	8,760
Friday, 4/27/51	1,110	9,000
Saturday, 4/28/51	1,200	9,130

TABLE 2

Monthly Refuse Collections

	Tons
January	370,000
February	354,000
March	395,000
April	380,000
May	270,000
June	265,000
July	256,000
August	254,000
September	250,000
October	335,000
November	348,000
December	375,000

Refuse after being collected is disposed of either by delivery to an incinerator or a sanitary landfill or loaded onto barges for transportation to an island fill. Each district is assigned definite disposal points when making up its day's schedule.

About 10% of the collection force is assigned to night work to take care of special locations such as shopping centers, theatrical districts, financial districts and other locations where the traffic is extremely heavy during the days. During the winter months about one-third of all units and crews are assigned to collections at night. This organization, known as the Night Plow Organization, is an alerted group which quickly can be converted into a snow-fighting force. On word of impending storms they are called in from their collection routes to mount snow plows on the trucks; man salt, sand spreaders and other snow-fighting equipment; and sally forth to combat the snow if it comes.

Assigned to the Bureau is a spe-

(*Continued on page 52*)

WHAT DO WE DO IF

Eye-Opening Civil

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IT DOES HAPPEN HERE?

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VERTICAL TURBINE PUMP APPLICATION

R. H. BIRD,
Designer, Peerless Pump Division
Food Machinery and Chemical Corporation

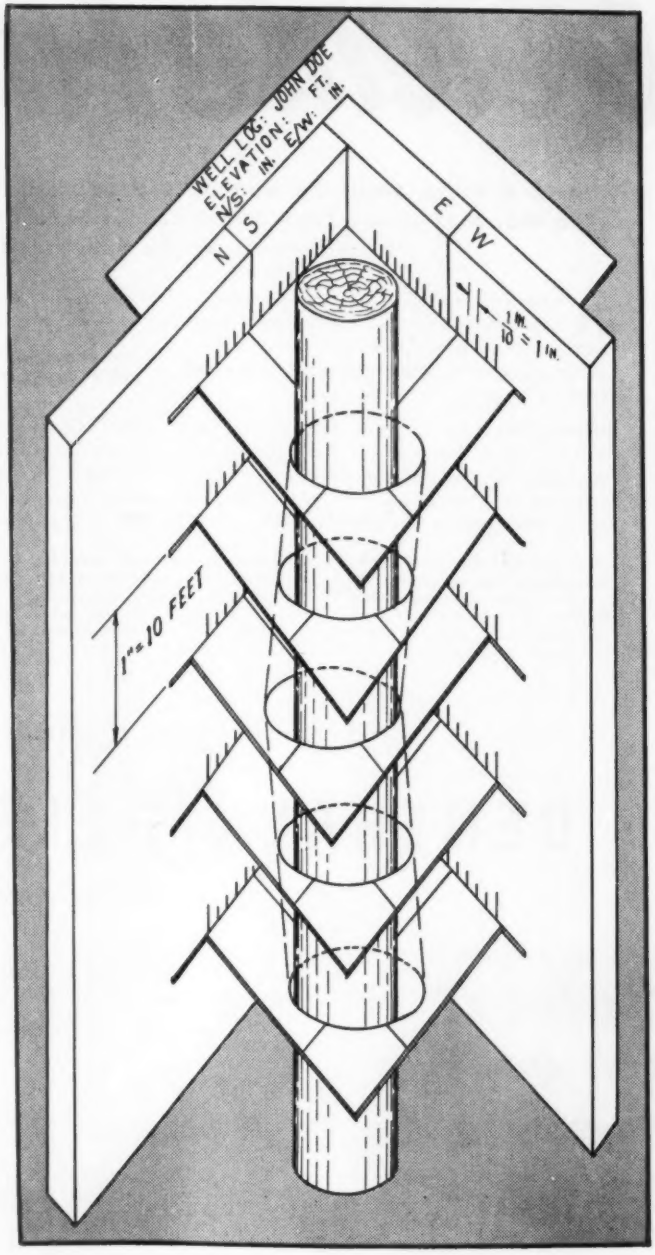
BEFORE drilling a well, the probable characteristics should be obtained from available data on nearby wells and careful attention given to such factors as depth, diameter, screen size, sand production, and the general perviousness or stability of the strata which might contribute to the collapsing of the well if production were excessive.

Consideration should be given to the chemical quality of the water such as the pH and the presence of carbon dioxide which is somewhat a measure of corrosion and dictates special materials for the pump. Further, the presence of iron or surface contamination of the water affects the potability and usefulness unless treatment is provided prior to use.

The usual graphic method of plotting the log of a well by north-south and east-west planes gives at best a distorted view of the crookedness or vertical misalignment. The use of a slotted frame, Fig. 1, having adjustable cards will show the three-dimensional condition of a well. The log data are used and the cards representing the well opening at various elevations can be kept on file. A piece of wooden dowel of proper scale to represent the maximum pump and column can be inserted through the series of card openings and points of interference directly determined. On this basis the proper location of column aligning spiders can be fixed to assure the straight line-shaft.

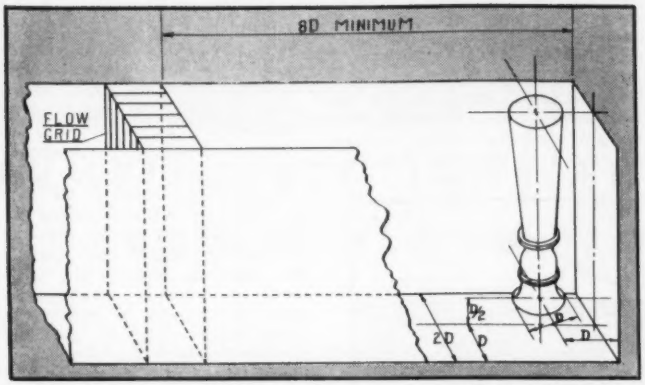
When the well perforations are above the pump bowls, there will be objectionable air entrainment and false water level datum will be registered including the velocity head and friction losses around the pump bowls. This condition is shown in Fig. 2.

The production characteristics of the well are as important as those



● ***FIG. 1. Three-dimensional method of making a well log.***

IN WATER SUPPLY SYSTEMS



● ***FIG. 4. Recommended layout for pump sump, showing dimensions.***

of the pump and sufficient test data should be taken to define the various pumping levels from the static through the normal range and into the "breakdown" region. Such a graph, Figure 3, will aid greatly in planning the efficient performance of the pumping system. A good well is costly and demands proper use to avoid overpumping which may result in sanding or collapsing.

For supply sources such as rivers and lakes, there is small change in the pumping levels but the sump becomes an important component which should be designed on the basis of scale model tests. The use of a screen or trash rack is sometimes required and allowance must be made for periodic cleaning and inspection. Fig. 4 shows a suggested form. It is preferable to install one pump per sump.

The Pumping Unit

The choice of the pumping unit is important in several ways and use should be made of the engineering resources and experience of a reliable and well-established manufacturer. The pump performance characteristics must be carefully fitted into the total plant requirements, which may vary widely, especially in applications for industry. The steep head-capacity curve may be quite suitable for use with fluctuating well levels, but the system-head of a processing plant may require the flat type of curve for which pressure would not be excessive when valves are closed.

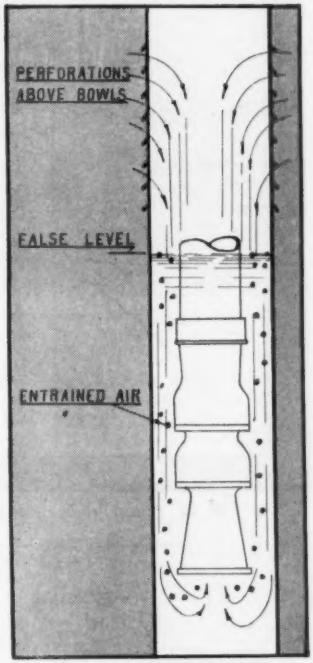
Usually, the bowl diameter has been determined by the manufacturer on the basis of the nominal well size with respect to sufficient clearance to allow free entry. In extreme cases, when indicated by deformities in the well or because some of the inflow is above the bowls, it may be advisable to choose the next lower nominal size. There may be a further limitation due to the restricted production of the well, suggesting a lower capacity pump. The initial cost and efficiency of at least two pump sizes should be compared over the amortization period in terms of power cost.

The graph, Figure 5 shows the usual pump performance in terms of capacity. The choice of the normal pump quantity (100%) should be made with respect to the normal well quantity which is about 15% below the beginning of the "breakdown" region. It is desirable to have the maximum horsepower of the pump near the requirement for the normal quantity. In the case of high capacity pumps where the shutoff horsepower is higher than required for normal quantity, the engine or motor must be sufficiently oversize or protected by devices to stop the pump or bypass the flow.

Since the head or pressure of the pump is usually more directly indicated by gauges, it is sometimes more useful to the plant operator to have the efficiency of the pump and total system plotted against head instead of the usual coordinate of capacity. In this way the effects of wear and corrosion, as well as the loss of efficiency, are more easily visualized.

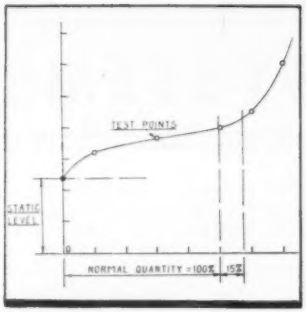
Operating Cost Factors

As an example of operating costs in terms of changing plant efficiency, assume an amortizing period of five years (21,600 hours at 12 hours per day), a power cost of 1½ cents per kwh and a nominal pump load of 100 bhp. With a 91% motor efficiency, the plant requires 1,773,000



● ***FIG. 2. Too high perforations cause air entrainment.***

kwh at a cost of $26,600. If the overall plant efficiency lowers from 75% to 74%, the operating power cost would be increased $350 for this one point drop. Such an index can be used in the proper multiples



● *FIG. 3. Production of well.*

to decide the best point to make repairs or to replace obsolete equipment. If Federal power allocation and conservation should be applied, such a check of changing performance would be quite valuable.

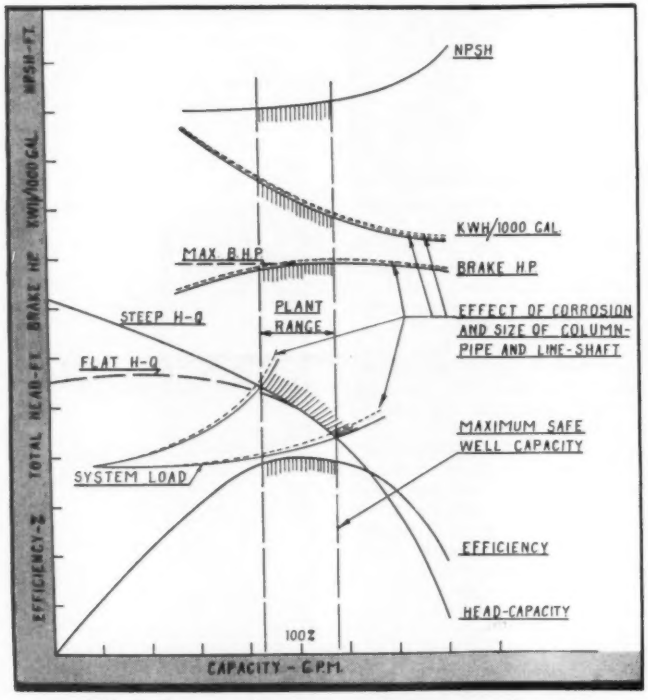
For engine operation it is advisable to choose a pump that has nearly constant efficiency at normal capacity for the expected speed range. Selection of an engine with adequate service factor for continuous duty is of extreme importance. To enable the plant operator to limit the range over which any one pump of a group should be allowed to run, it is suggested that the power quantity of kwh per 1000 gallons or the equivalent fuel consumption be plotted for each pump for various capacity rates and heads, as shown in Figure 5.

Some applications require the pump to be capable of reverse rotation without excessive speed. From studies on the transient behavior of pumps, the run-away speed can be determined. For the common pump types this generally is not sufficiently high to damage either pump or motor. In passing, it is noteworthy that modern pumps are nearly as efficient when operated as turbines.

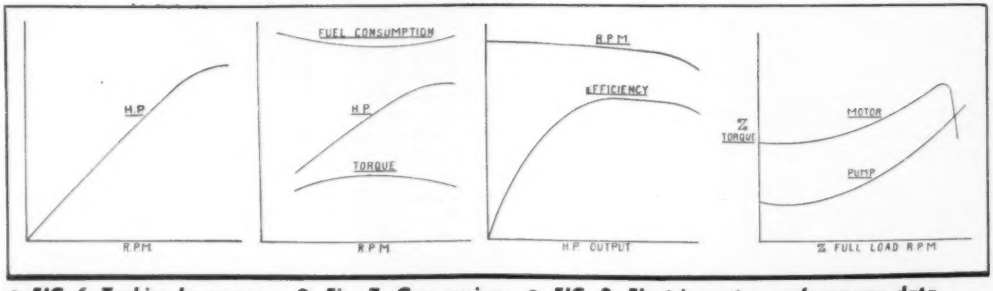
Consideration must be given to the cavitation characteristics of the pump if safe operation is expected for restricted suction conditions. If the operating range of the plant could be narrowly controlled, it would be possible to choose the pump which would run near the threshold of cavitation with maximum efficiency. As previously mentioned, wells which have some or all of the perforation above the bowls are a distinct handicap to a pump since the apparent water level is decreased by the velocity head and friction losses, all of which tend to aggravate suction conditions and induce cavitation. For unusual requirements due to volatile liquids, hot water, or high lifts, the pump manufacturer should furnish the NPSH curve for the pumps. NPSH is the net positive suction head (absolute) above the vapor pressure of the liquid pumped or is equal to the atmospheric head less the vapor pressure plus or minus the suction head. The sign of addition or subtraction depends upon whether there is suction head like submergence or suction lift respectively.

The choice of mechanical features in the pump unit should be made

(*Continued on page 62*)



● *FIG. 5. Pump performance graph in terms of capacity.*



● *FIG. 6. Turbine hp vs rpm.* ● *Fig. 7. Gas engine.* ● *FIG. 8. Electric motor performance data.*

flooding of the streets, a gate is swung across the outflow sewer, uncovering an opening into the pump suction chamber. The pumps discharge into the outflow sewer beyond the gate, providing positive drainage even at record tide levels.

Station "B" is located at an elevation of 3½ ft., the lowest spot in town. At this station there are two pumping units, a 54-in., 75,000 gpm. FM pump driven by a 325-hp. F-M

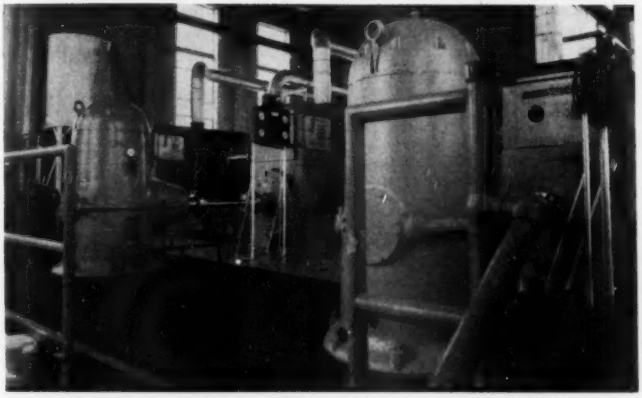
● ***STATION "A," showing the pleasing exterior appearance.***

PUMPING STATIONS AND SEA WALL PROVIDE FLOOD PROTECTION

UNLESS it were protected, the low-lying land that includes much of the business section of Corpus Christi, Texas, would be subject to flooding from time to time. This flooding could occur from high waves due to Gulf winds, or from heavy tropical rains which sometimes aggregate 2 inches in a half-hour or less. Some ten years ago, a 14-foot seawall was constructed, extending two miles from high land to the port area, which has a natural elevation of 15 feet.

This serves to keep the bay waters out, even if they reach the 11-ft. levels of the typhoon of 1919, but the seawall leaves the main business district and the shore front in a pocket without natural drainage. This area ranges in elevation from 3½ to 8 ft. above sea level. First essential in solving the problem was a network of storm sewers to carry off rain water. Second was a series of outlets through the seawall to permit run-off at normal tides with gates to keep the sea out at abnormally high tides. Finally, provision had to be made for discharge of rain waters at high tide.

With Myers & Noyes as consulting engineers, Mayor Leslie Wasserman, Director of Public Works H. H. Stirman and General Superintendent of Public Utilities J. W. Cunningham developed a drainage system designed to meet all the problems. A network of storm sewers was constructed, covering every block in the low area and draining to a 9-foot U-shaped sewer parallel to the waterfront. Outflow lines with automatic gates were provided to permit drainage by gravity whenever the tide was below 4 ft.



● ***THERE are three 75,000 GPM pumps in Station "A."***

The Pumping Stations

Final step was the construction of two pumping stations to handle all drainage when tides blocked the normal outflow and to dispose of rain water when rainfall was too heavy for normal gravity flow to clear. Station "A" has three 54-in. vertical Fairbanks-Morse pumps, each rated at 75,000 gpm. at a 9-ft. head. Each pump is driven by a 325-hp. FM diesel through Farrel-Birmingham gears which reduce an engine speed of 514 rpm. to a pump speed of 301.6 rpm.

Normally, water flows by gravity from the 9-ft. sewer through an 8-ft. concrete outflow sewer which extends 100 yards beyond the seawall into the bay. When the tide rises and threatens to back up in this line, or when rain is so heavy that pumps are needed to prevent

diesel, and a 36-in., 27,000 gpm. FM pump driven directly by a 75-hp. F-M electric motor. The electric pump is automatically controlled by the level of water in the suction chamber and guards against rain water damage in the lowest section of the city. The pump discharges into an elevated outfall from which the water flows to the bay by gravity.

It was deemed important to make the plants self-sufficient and capable of functioning in emergency without any outside source of power. After all, the big job is to keep the town dry even when high winds disrupt power transmission lines. Heavy-duty diesels were chosen to insure dependable performance. Chief Operator G. B. Dodds reports that the diesels can be started and put to work in one minute. It takes

four minutes to close the main sewer gate.

Wind and rain don't give much warning in this part of the country and the city keeps an operator on duty 24 hours a day. Since the two plants went into service in July, 1949, Corpus Christi has had several heavy rains which would have damaged the city were it not for the drainage pumps. On one such occasion, 2 in. of rain fell within 30 minutes.

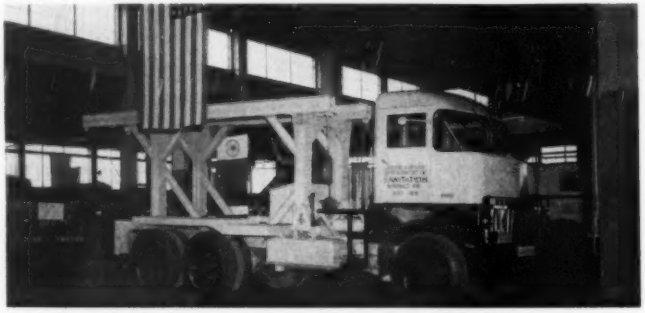
Even in the case of light rains, the diesel-pumps provide a valuable safety factor. If the sewers are filling up, the operator runs two diesels for 30 minutes, which usually is enough to empty the sewers and provide 5,000,000 gallons of underground storage capacity. On top of this, the two plants have a combined pumping capacity of 327,000 gpm.

The city has made these stations attractive, efficient and dependable. Built in a setting of palm trees, bright flowers and green lawns, the buildings are of steel-reinforced concrete and Austin stone. Interiors are lined with tile.

NEW YORK'S REFUSE COLLECTION

(*Continued from page 45*)

cial group designated as the Auxiliary Field Force. Among its duties are the removal of large dead animals which number about 500 per year, including oddities such as whales washed ashore; towing illegally parked and abandoned cars off the streets; and assisting the regular collection force in emergencies. It has many special assignments such as acting as the moving agency for the Department and is called upon frequently to do jobs for other departments of the City such as removing or hauling old records to incinerators for destruction.



● ***WARD La France cab-over-engine 6 x 6 wrecker unit.***

The Department truck fleet numbers 1,800 of several types. These trucks are housed in fifty garages located strategically throughout the city. Approximately 1,300 trucks operate during the day and 200 at night. The balance are in reserve or on Preventive Maintenance or repair. Minor repairs are done in the garages and major repairs at the Central Motor Repair Shop. As in the case of most muncipalities, continuous efforts are being made to improve and modernize this fleet in the interest of economy and efficiency. Wars, depressions and defense activities have interfered with the program of proper replacement. However, since 1948 this Department has been able to secure 810 new trucks and will shortly advertise for 140 more. In the meantime, a program of condemnation of obsolete equipment is going forward. About 300 old trucks have been stripped and sold for salvage.

Extensive studies, modifications and tests have been made to improve and obtain the best units for our needs. Factors considered were reliability, ease of loading, low loading height, speed of loading, compactability, economy and maintenance costs. We have purchased both the batch type loading-compacting units and the continuous escalator loading compacting units. There has been a considerable saving to the City in the substitution of modern units over the older outmoded types and this saving has been used to improve and expand the collection services. For example, the purchase of mechanical loading units has enabled the Department to reduce the loading crews from four on the outmoded box types to three on the new units releasing about 350 men for use in expanding service.

The Department has contracted for and is awaiting early delivery of fifteen White chassis fitted with Dempster Dumpster hoists and 87 Dempster Dumpster Containers. These units will be used in special locations such as markets, hospitals and schools.

In addition to the major pieces of collection equipment listed above, the Bureau is equipped with passenger cars for officials and supervisors, snow-fighting equipment, utility trucks and a multiplicity of other auxiliary automotive equipment.

All the personnel of the Department and its equipment are enrolled in the Civil Defense Corps of the City of New York. In time of emergency it will be able to render great assistance clearing the streets, removing debris and decontaminating effected areas.

Commissioner Andrew W. Mulrain is in charge of the Department of Sanitation of the City of New York. The author is the Director of Operations. All operations described in this paper are carried out in the Bureau of Street Cleaning and Waste Collection headed by P. Anzalone, Assistant to the Commissioner, and his Chief of Staff Joseph M. Hayden. Mr. Hayden is assisted by Deputy Chief of Staff Sherwood K. Basil.

Table 3—Equipment List

Type	Chassis Mfr.	Body Mfr.	No.
Box	GMC	Heil	210
Escalator Loading	Autocar & GMC	Heil & Gar Wood	815
Batch Compactor	Autocar & GMC	Gar Wood	501
Escalator Compactor	Autocar & GMC	Heil	50
Escalator Compactor	International Harvester	City Tank	210
		Total	1,786
Wreckers	Ward LaFrance & FWD	Gar Wood & Fitzgibbons & Crisp	43

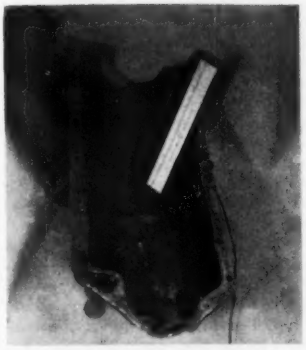
How Correct Lubrication Saves Public Works Dollars

N. T. BRENNER,
Chief Fuels and Lubricants Engineer
Tractor Section,
Gulf Oil Corporation,

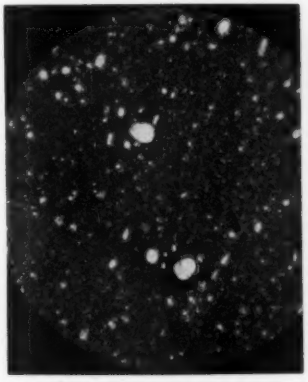
THE importance of an adequate and systematic lubrication program covering all types of equipment employed by cities, counties, and other political subdivisions no longer requires particular emphasis. During the equipment and parts shortage of World War II, operators were brought to the realization that proper lubrication and preventive maintenance do pay off in longer life, lower costs, and increased efficiency. An outstanding example may be taken from an allied field. Many contractors, who formerly beat their equipment to death in the race to move dirt, learned that an occasional pause to lubricate and inspect resulted in more yards per shift and lower costs per yard. Some of these same contractors are now among the most particular purchasers of quality lubricants and the most insistent upon systematic lubrication. Some have even provided completely equipped lubrication trucks which proceed over the job, stopping all equipment for necessary lubrication and inspection during every shift.

The Public Works Problem

Undoubtedly, the public works engineer is equally conscious of the importance of adequate and systematic lubrication, but he often has a more complicated problem on his hands. Few engineers are called upon to supervise a more diversified collection of machines, and these are often scattered over a large area. The equipment may range from passenger cars and trucks of all sizes and types to bulldozers, graders, snowplows, compressors, and miscellaneous construction equipment. Not only are their individual lubrication problems widely divergent, but it may not be possible to centralize them regularly at a point where trained personnel and equipment can be organized into a practical lubrication and maintenance program.



● ***FIG. 1. Accumulation of "low temperature sludge."***



● ***FIG. 2. Water droplets present in oil sludge.***

These are problems beyond the scope of a general discussion and must be worked out by an analysis of the circumstances of each individual case and a practical solution of the economics involved. It may, however, be suggested that problems involving a relatively small number of units, particularly passenger cars and light trucks, can often be considerably simplified by utilizing outside agencies for lubrication and preventive maintenance. Progressive car agencies and service stations have the products, equipment, and know-how to take over this work, and many of them are equipped to render follow-up service to insure regularity.

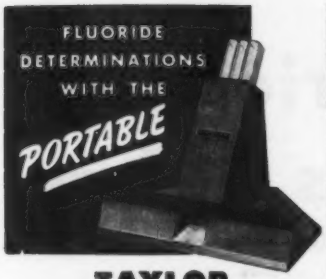
Where sufficient equipment is centralized to justify the establishment of a lubrication program, the problem resolves into three considerations:

1. Selection of proper oils and greases; 2. adequate lubricating equipment; and 3. selection and training of personnel.

Selecting the Lubricant

For the engineer in private enterprise, the selection of proper oils and greases presents no particular problem. The manufacturers of the equipment have specified the types of lubricants required for each application and reputable oil companies are prepared to furnish products demonstrated by test and field experience to do the job. Here, again, the public works engineer may be handicapped by the necessity of using oils and greases procured on the basis of competitive bidding on specifications. The specifications may or may not be drawn up so as to provide the types and quality of lubricants actually required to do the job. And even if they are properly drawn up, one of the greatest weaknesses in any specification approach to the purchasing of lubricants is that any acceptable specification will generally be low enough to include products that will barely do the job. And this is what the use of minimum specifications usually brings about . . . the purchase of the most cheaply constructed lubricant that will pass the minimum limits of the specification. Certainly, the oil selected on this basis can not be expected to produce the best service performance.

While the engineer in public works can not always avoid these evils of specification buying, he can often use his influence to minimize them



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by seeing that the specifications are modernized and that they are set up to cover those types of oils and greases required by his equipment. If he has reason to suspect that the lubricants being supplied to him are not of the type and/or quality that would be recommended by the same supplier on the basis of performance rather than price, he must take compensating steps. More frequent lubrications and more careful maintenance may be indicated.

It is not to be inferred that competitive bidding on specifications results, per se, in the purchase of inferior products. A lot depends upon the specifications, of course. But the engineer in public works should be alert to the fact that he may be at a disadvantage in comparison to his neighbor in private industry who can take full advantages of the unrestricted recommendations of his supplier based entirely on performance.

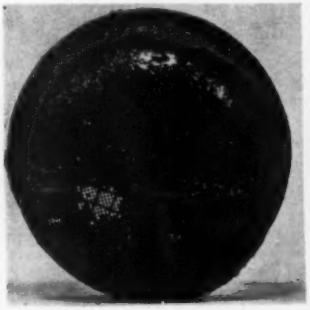
The selection of adequate lubricating equipment will depend largely on the volume of work. Oil storage and dispensing equipment should protect against dirt and contamination and provide convenient dispensing without waste. Hand grease guns will satisfactorily handle a few pieces of equipment, but air operated lubricant dispensers and power guns are essential for the proper and economical lubrication of a fleet of any considerable proportions.

Training the Personnel

Properly trained and conscientious personnel is a most important factor. Quality oils and greases and modern lubrication equipment avail nothing unless correctly and regularly used. If the proper type of individual is selected, the local oil company representatives can often be helpful in training him in proper lubrication procedures. Most oil companies publish lubrication guides covering passenger cars and trucks and are equipped to furnish lubricating instructions for tractors, bulldozers, graders, compressors, and other equipment. It is, of course, of paramount importance that a regular schedule of lubrication and preventive maintenance be set up and supervised to see that it is followed. A card index will be found invaluable to this end. It should contain a card for every piece of equipment, which card should record the date and mileage (or operating hours) at which each service was performed. A tickler system is helpful in assuring that each service will be repeated at the proper interval.

Stop-and-go Problems

Passenger car and truck engines, particularly in city work, are subject to what is generally termed "low temperature sludge". This is the sludge of a mayonnaise consistency found in crankcases and valve compartments. It is called "low temperature sludge", not because it is found only when the weather is cold, but because its formation is encouraged by low temperature in the engine, say below about 140°F. water temperature. This sludge is often incorrectly attributed to a breakdown of the lubricating oil but, actually, oil deterioration products generally constitute a very minor portion of such sludge. Its main constituents are water condensed on the relatively cool engine walls, unburned or partially burned fuel blown past the piston rings, and dirt drawn in through the intake manifold and breather. These are whipped up into an emulsion in the engine and circulated along with the oil to deposit out where oil circulation is slow. Figure 1 shows a crankcase pan with a bad case of low temperature sludge. Figure 2 shows the presence of water droplets in a magnified view of this sludge. Figure 3 shows a screen almost completely clogged and about ready to cause trouble.



● ***FIG. 3. Clogged oil screens invite trouble.***

Stop-and-go driving, short runs, and excessive idling, such as encountered in city work, result in low engine temperatures. Excessive use of the choke also contributes to this condition. Considerable relief will be experienced from this type of sludge formation by the use of higher heat thermostats and/or winter fronts. Frequent crankcase oil changes are also necessary for equipment engaged in this type of service. It has also been recently determined that motor oils with

high detergency, in excess of that found in ordinary "heavy duty" oils, will assist in reducing the formation of low temperature sludge.

Oil Filter Functions

The true function of the oil filter in engine lubrication is not universally recognized. Some operators completely ignore the filter, while others depend upon it to perform functions for which it is not designed or intended. Either extreme is erroneous and denies the oil filter its true function as a valuable auxiliary to adequate lubrication. If the filter is serviced at proper intervals it is very helpful in removing filterable contaminants from the crankcase oil. Dirt, sludge, and abrasives, which might otherwise circulate through the bearings and other vital engine parts, are trapped in the filter and disposed of when it is serviced. However, the filter cannot be expected to remove all of the harmful contaminants. Some of these are soluble in the oil and are not filterable. Hence, frequent filter service cannot be substituted for crankcase oil changes. Best overall results will be secured by changing both oil and filter cartridges, at proper intervals.

The condition of the oil or of the filter cartridge should not be judged by observing the color of the crankcase oil on the dipstick. This has always been a questionable practice, but is more so now that detergent oils are coming into quite general use. These oils hold harmless microscopic soot particles in suspension, which may darken the oil very rapidly in service. This material is too finely divided to be removed by the filter. Therefore, the color of such oil is not a conclusive indication of the condition of either the oil or the filter.

Bearing Failure

Those responsible for the maintenance of gasoline or diesel engines will profit from a clear understanding of the fundamental causes of bearing failures. All too often these are charged to the lubricating oil. As a matter of fact, few bearing failures can ever be traced to deficiencies of the oil, when oil of any reasonable quality is used. One exception to this statement is that "regular type" motor oils may contribute to the corrosion of hard alloy bearings and only "premium" or "heavy duty" oils should be used in equipment containing such hard alloy bearings as copper-lead, cadmium-silver, etc. Most bearing failures are caused by lack of lubrication (running out of oil or interrupted oil flow), improper installation, overloading, overspeeding, lugging, or other abuse or neglect. Lubricating the bearings is one of the easiest jobs the oil has to do and a thorough investigation should be made before blaming it for bearing failures.

The frequency of crankcase drains is a moot question upon which much has been written. A good deal of the rebuttal on both sides ignores certain fundamental generalities and exceptions of the opposition. It is the writer's belief that frequent crankcase drains are particularly beneficial in the case of equipment operated in stop-and-go service with considerable idling and little open-road, high-speed driving. This stop-and-go service builds up the contaminants in the oil most rapidly and affords the least opportunity to drive them off by heating the oil in open-road service. It is readily demonstrated that pennies can be saved by less frequent drains, but closely controlled tests and years of experience by fleet operators clearly indicate that dollars are realized in longer life and reduced repair expense when reasonable drain periods are observed.

Gear Lubrication

The correct application of gear lubricants has been a confusing subject to many persons for a number of years. Straight mineral gear oils, mild extreme pressure lubricants, and hypoid gear lubricants have all been available and variously recommended by individual equipment manufacturers and lubricant suppliers. Each type is designed for a particular purpose and difficulty may be experienced in some cases if an incorrect selection is made. This situation has been greatly simplified during the past few years by the introduction of the so-called "multi-purpose gear lubricants." Although there are some applications where one of the three types mentioned above is still preferred, the multi-purpose gear lubricants offer a very satisfactory and greatly simplified solution to the lubrication of enclosed gears in automotive and construction equipment, particularly the transmissions and differentials of cars and trucks. They are not intended for automatic and semi-automatic transmissions in passenger cars or for fluid couplings and torque converters found in some trucks, buses, and construction equipment. These require special lubricants and can-

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not be satisfactorily operated on any type of gear oil. Multi-purpose gear lubricants in the SAE 80, 90, and 140 grades are readily available from reputable suppliers and, as stated, will be helpful in simplifying the entire problem of lubricating conventional transmissions, differentials, final drives, and enclosed gear boxes on equipment.

It may be stated that the engineer responsible for stretching a limited budget over his equipment operations will meet with the greatest success by a generous application of preventive maintenance, of which lubrication is an important part. Here, certainly, "a stitch in time saves nine" and present equipment repair and replacement costs indicate that the nine are well worth saving.

Special Sludge Treatment

(*Continued from page* 35)

fed from concrete buggies operating on a runway around the top of the tank. There will be a gasholder 56 ft. in diameter and 20 ft. high, with a steel gasholder cover.

The filtration building is 99 ft. by 154 ft., two stories high, and houses four primary and four secondary elutriation tanks, each 16 ft. wide, 61 ft. long and 11 ft. deep; the sludge pumps; and four vacuum filters, 8 ft. in diameter and 14 ft. long. The dryer building, 54 ft. by 197 ft., three stories high, houses three Raymond driers rated at 6,250 pounds of water per hour. This building also provides space for sacking and storage of the dried sludge.

The two-story receiving and thickening building contains sludge pumps and two receiving and thickening tanks 21 ft. by 91 ft. by 12 ft. deep. Other principal buildings include the administration building, three stories, 50 ft. by 175 ft., which contains offices, laboratory and shower and locker rooms; the machine shop and garage; the digestion control buildings, two in number, octagonal, 70 ft. in diameter, heat exchangers; and the electric substation and filter cake receiver, one story, 25 ft. by 115 ft. The contract for this plant was awarded to MacDonald, Young & Nelson, Inc., and Morrison-Knudson Co., Joint Venturers, in Aug., 1950, for $4,486,000, with 600 days allowed for completion.

Sludge Force Main

The sludge force main, which will convey sludge, grease and scum from the North Point plant to the sludge treatment plant, is 5.93 miles long. The main consists of 10-inch concrete cylinder pipe in 30-ft. lengths, with bell and spigot joints. In the line are four blow-off vaults and ten drain and clean-out vaults. Each vault has a 2-inch blow-off connection for cleaning the line and a pressure gauge to indicate the operating condition. In addition, each drain and clean-out vault has facilities for draining the contents of the sludge line into a nearby sewer in case of emergency.

The sludge pumps, two in number, are horizontal centrifugal pumps located at the North Point plant. These have capacities of 700 and 1,000 gpm. respectively, or a combined capacity of 1,400 gpm against a total dynamic head of 380 ft. with a velocity through the pipe line of 5.7 fs.

Elmer E. Robinson is Mayor of San Francisco and Thomas A. Brooks is chief administrative officer. Sherman P. Duckel is director of Public Works. Ralph G. Wadsworth is city engineer and C. J. Geertz is assistant city engineer.

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PUBLIC WORKS DIGESTS

THIS section digests and briefs the important articles appearing in the periodicals that reached this office prior to the 15th of the previous month. Appended are Bibliographies of all principal articles in these publications.

SEWERAGE AND REFUSE.. 57
HIGHWAYS AND AIRPORTS.. 65
WATER WORKS.. 70

THE SEWERAGE AND REFUSE DIGEST

Sludge Drying Bed Performance

The author believes that it is wrong to measure sludge bed performance by any of the units commonly used—number of fillings or applications per year; or cubic yards of wet sludge drawn per year; or pounds of solids applied per sq. ft. per year. Instead, he suggests as units the gross and net bed loadings; defining gross bed loading as "pounds of solids applied per square foot per 30 days of actual use;" and net bed loadings as the "product of the gross loading multiplied by the percent solids in the sludge removed from the beds." Next to temperature, the solid content of the sludge applied to drying beds is the most important factor influencing bed performance. The next most important is the moisture content of the sludge as removed. Unless these three factors are taken into consideration it is impossible to measure the effect of the many other less important variables. Data from a large number of plants of different types and locations indicate that the relationship between average annual bed loadings and the solids in the applied sludge may be expressed by the formula:

Gross bed loading = (0.96 x % solids in applied sludge) —1.75.

Net bed loading = (0.35 x % solids in applied sludge) —0.5.

However, these formulas do not apply to old, thoroughly digested, "dead" sludge or to sludges containing excessive amounts of grit. If the actual bed loadings obtained are first expressed as percentages of the theoretical loadings calculated from the above formulas, and then compared, it is possible to measure the effect upon sludge bed performance of other variables, such as depth of wet sludge applications; covering beds; or use of alum or other chemicals as sludge drying aids.

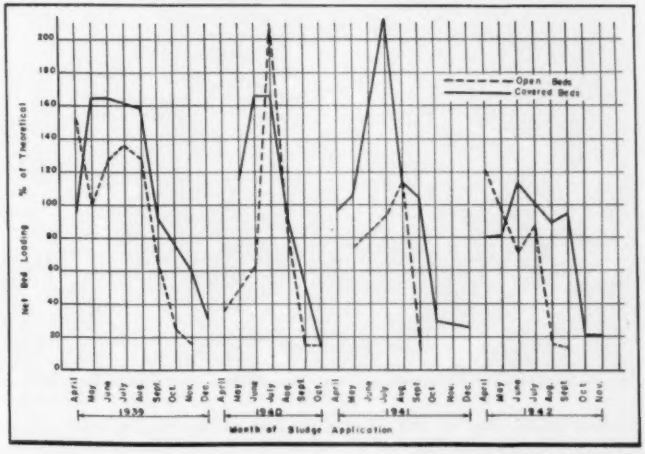
T. R. Haseltine—"Measurement of Sludge Drying Bed Performance;" *Sewage and Industrial Wastes*, September.

Profits in Treatment Of Industrial Wastes

There are 163 canneries in Indiana, of which 99 have adequate waste treatment, and 30 have inadequate ones. Among other wastes-producing industries are 3 antibiotics plants. One antibiotics plant recently developed a component of animal feed by evaporation and drying a portion of its wastes, thus producing a profit; in addition to which this reduces to 300-700 lb. the 5,000 lb. per day of chlorine formerly used to treat the wastes. Steel mills in Indiana are planning more flue dust recovery, the recovered iron making the process profitable.

In Illinois, the distilling industry has developed a by-product recovery process which allows the manufacture of a high-quality cattle feed which has a sale value considerably over its recovery costs.

In Wisconsin, the Sulphite Pulp Manufacturers League has developed a method for producing fodder yeast by aerobic fermentation of sulphite liquor; a plant at Rhinelander producing approximately 8,000 lb. of feed yeast per day from



Courtesy Sewage & Industrial Wastes

● *SLUDGE drying bed performance records.*

50 tons of pulp. At present, the liquor from 10 mills is being used as a dust layer and road binder on unimproved roads. The state's 2,250 dairy plants process 15 billion pounds of milk annually, and the wastes they produce annually contain 300,000 lb. of milk, much of which could be saved by good housekeeping. Cheese factories in the state produce 5 billion pounds of whey a year, about 60% of which is sold to condenseries which produce dried whey powders, riboflavin, folic acid, milk sugar, lactalbumin and other by-products; while the remaining 40% is used for hog feed.

Perry E. Miller, A. Paul Troemper, T. F. Wisniewski and O. J. Muegge —"Central States Set Pace in Industrial Wastes Treatment;" *Wastes Engineering*, October.

Ultrasonics in Sewage Treatment

Ultrasonics is being applied in the precipitation of industrial smokes and the homogenization of milk. Experiments have been conducted to learn what use can be made of it in sanitary engineering. Ultrasonic vibrations were passed into activated return sludge and mixed liquor by means of a piezoelectric generator with a power output on the order of 30 watts, the frequency being between 238 and 242 kilocycles. Settling was more rapid after exposure to the vibrations, reaching a maximum after a period of 15 minutes of vibration; settling twice as rapidly after 10 min. of vibration, and three times after 15 min. as did the control samples. Varying the power output indicated that, by increasing it, the time period required to reach the point of maximum settling can be shortened considerably.

Walter A. Lyon—"The Effect of Ultrasonics on Suspended Matter in Sewage;" *Sewage and Industrial Wastes*, September.

Usage of Grit Chambers

The author studied the 1948 "Inventory of Water and Sewage Facilities in the United States" to learn the use of grit removal units in sewage treatment plants with respect to type of sewer systems serving the plant. He found that, of the 796 plants serving more than 30,000,000 persons which had grit chambers, 522 (65.7%) were connected to separate sewer systems. The major portion of the population is served by plants connected to combined sewers or systems incorporating both types. Grit removal units are found in 13.1% of the total number of plants, serving 62.4% of the population. They are most common in plants serving the larger communities and in states in the northeastern quarter of the United States. (Connecticut, 46.0% of the plants, New York 36.7%, Rhode Island 33.1%; Nebraska 0.8%, So. Dakota 1.3%, Oklahoma 1.0%). Of important significance is the number of plants in small communities having grit chambers, the majority of which are served by separate sewers. Figures for quantities of grit removed from 30 plants are given. For separate sewers these range from 0.76 to 4.8 cu. ft. per mg; for combined sewers from 0.5 to 10.0 cu. ft. per m.g.

John R. Thoman — "Statistical Summary of Grit Chamber Usage as Related to Type of Sewer System;" *Sewage and Industrial Wastes*, September.

Courtesy Rootes Motors, Inc.

● ***GENERAL view of the vehicle display at the Public Works Congress and Equipment Show of the American Public Works Association, held at Detroit during September. A record-breaking crowd visited the displays during the four-day meeting.***

Revenue from Digester Gas

In 1945 the City Council of Johannesburg, South Africa, signed an agreement with African Explosives Chemical Industries, Ltd. to supply not less than 300,000 cu. ft. per day of digester gas containing not less than 62% methane at a price of one shilling per 1,000 cu. ft. for 25 years. That company erected a large-scale plant which now is in continuous operation producing cyanide from the methane and ammonia. The revenue to the city is now approximately £9,000 per annum, is gradually increasing and should eventually reach £40,000 per annum. The cyanide is being used in gold recovery and about half that used in South Africa is manufactured from sludge gas.

E. J. Hamlin and H. Wilson—"Sewage Research in South Africa;" *South African Municipal Magazine*, August.

Safe Practices At Sewage Plants

The California Dept. of Public Health recommends that, for the safety of employees in sewage plants and sewers: 1—Open clarifiers and other tanks should be provided with hand railings around the entire tank and walkways. 2—Machinery, such as exposed shafting, gears and other moving parts, should be guarded. 3—Pumping stations and parts of disposal plants are required by State law to have vapor-proof fixtures and explosive-proof motors. 4—Access ladders to pits and manholes should be maintained in good repair. 5—All pumping pits, es-

pecially if over 6 ft. deep, should be provided with adequate ventilation. 6—If continuous ventilation is used, at least 10 air changes per hour should be provided for dry wells and 25 for wet wells. 7—If ventilation is intermittent, it should be turned on at least 15 minutes before any one enters the pit, at a a rate to effect 60 or 70 air changes per hour. 8—The exhaust duct for pits should be so located that contaminated air is removed from near the bottom of the pit. 9—Safety equipment should be provided for each manhole, pumping pit or other underground crew; this to include breathing apparatus, life line and harness, flame safety lamp, hydrogen sulfide detector, and small combustible gas indicator. 10—No employee should be permitted to enter a manhole unless a watcher remains at the surface.

"Occupational Hazards Studied in Sewage Treatment Plants;" *Wastes Engineering,* October.

Studies of Ground Garbage

Detroit, Mich., encourages the use of garbage grinders as resulting in improved environmental sanitation and convenience. Experiments have been conducted by the City Engineer's office to obtain data on the proportion of garbage that goes into solution or colloidal suspension in the grinding process, the chlorine demand and the BOD of the liquid portion of ground garbage, and the physical characteristics in relation to particle size. It was found that, on the average, 25% of the dry solids of garbage will go into solution or nonsettleable suspension in the grinding process. Limitations on acceptable garbage grinder operation should specify that not more than 30%, on the dry basis, pass a No. 40 U. S. Standard sieve. (A recently recommended requirement that not more than 5% pass a No. 40 sieve is considered impracticable).

If it is assumed that 100% of a community's garbage is ground and introduced into the sewer system for disposal at the treatment plant, the chlorine demand of the effluent from the primary sedimentation process may be increased 0.12 ppm, or about 4%, as a maximum, and the average increase in BOD would be from 20 to 25%. The increase in solids to be handled at a primary plant would average about 50%.

Clyde L. Palmer and Isadore Nusbaum—"Ground Garbage Studies at Detroit;" *Sewage and Industrial Wastes,* September.

Salmonella in Irrigation Water

Recent studies on the contamination of vegetables grown in sewage-polluted soils led to the opinion that "if sewage irrigation or night soil application is stopped one month before harvest, the fruit, if eaten raw, would not be likely vectors for the transmission of human bacterial enteric diseases." However, in the western states it is common practice to irrigate weekly right up to the day of harvest, and members of the faculty of the University of Colorado School of Medicine studied the public health hazard in using sewage-contaminated water for the irrigation of truck crops which may be consumed raw. *Salmonella* organisms were recovered from a significant proportion of samples of irrigation water contaminated with a primary treated sewage plant effluent. These organisms, however, were not recovered from samples of vegetables irrigated with this water; even though during a three-week period the irrigation ditch

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water consisted of 60% raw Denver sewage. It is to be noted that the common method of irrigating in this area is simply to allow the water to flow in the furrows between the rows of plants, and not to flood the field. Therefore, any organisms in the water would probably have to be splashed onto the leaves and stems above the ground or conveyed to the plant by some other means. Root crops, on the other hand, might be expected to be contaminated to a greater extent.

S. G. Dunlop, R. M. Twedt, and Wen-Lan Lou Wang—"Salmonella in Irrigation Water;" *Sewage and Industrial Wastes*, September.

Treating New York's Sewage

New York City's sewage treatment and disposal facilities during 1950 consisted of 13 treatment plants, some 25 miles of interceptors with 86 regulators, and 3 self-propelled sludge vessels, and 2 sludge barges. The quantity of sewage treated averaged 391 mgd, which was 41% of the total city flow. With 3 new plants expected to go into service in 1951 and 1952, the sewage treated will approximate 70% of the total. Operation and maintenance of these facilities required the services of 55 personnel, of which 39 were technical men, 459 were skilled, semi-skilled and unskilled workers; and 57 were members of the sludge vessel crews. Of the total 391 mgd treated, 290 were treated by the activated sludge process; 77 by plain sedimentation, of which 47 received chemical precipitation during the summer. The remaining 24 mgd was subjected to fine screening only. Chlorination was provided for 126 mgd for about 140 days during the bathing season. About 10,000 tons of sludge was used by the Park Department in making artificial topsoil; regrettably, the remaining 60,000 tons was dumped at sea. At four of the plants, 423,000,000 cu. ft. of sludge gas was used, mainly as fuel for engines with a combined output of 10,500 hp; an equivalent of utility gas would cost about $375,000. About 1,000 tons of sewage skimmings a year is sold for about $35,000. The cost per million gallons treated has increased from $10.13 in 1941 to $22.55 in 1950. Cost per dry ton removed increased from $17.12 to $26.94; and per ton of BOD removed, $27.24 to $53.61. Detailed descriptions are given of the treatment control by the engineers of sewage treatment; of repair and maintenance of mechanical equipment and structures, and of the electrical equipment, by the engineers in charge of those two sections.

Nathan I. Kass—"Operation and Maintenance of New York City Sewage Treatment Plants;" *Sewage and Industrial Wastes*, September.

Indices of Water Pollution

The coliform test for water pollution is not ideal but the *E. Coli* test of "Standard Methods" is generally accepted. In 1946, Winter and Sandholzer described a test for enterococci as a substitute. The authors made a comparative analysis of these two tests, which indicated that enterococcal densities followed the pattern of *E. Coli* indices. A correlation coefficient was calculated for the relationship between the two sets of indices and found to be +0.7. The enterococcus densities, however, were of lesser magnitude than the *E. Coli* densities, being isolated in an approximate ratio of 1:63 with *E. Coli*. More

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skill is required by laboratory personnel in performing the enterococcus test, but it can be completed in a shorter period of time than that required for a completed test for *E. Coli*.

William E. Lattanzi and Eric W. Mood—"A Comparison of Enterococci and E. Coli as Indices of Water Pollution;" *Sewage and Industrial Wastes*, September.

Determining D.O. in Industrial Wastes

Industrial wastes of many different types cause serious errors in the determination of dissolved oxygen by the Winkler method. However, the method may still be applicable for certain purposes when industrial wastes are present, but only if the resulting errors are recognized. Use of the polarographic method permits reasonably accurate determinations of dissolved oxygen, even under conditions which render the Winkler method quite inapplicable.

M. C. Rand and H. Heukelekian —"Determination of Dissolved Oxygen in Industrial Wastes by the Winkler and Polarographic Methods;" *Sewage and Industrial Wastes*, September.

BIBLIOGRAPHY

Engineering News-Record

Concrete-Pipemaking Method Gets First Use on Sewer Job. Sept. 13, Pp. 45-46.
Concentrated Sludge: The Laboon Process. Oct. 11, Pp. 30-32.

Municipal Engineering (England)

Listen to the Operator to Avoid Mistakes in Sewage Works Design. Sept. 28, Pp. 166-167.

Public Works

Removal and Disposal of Screenings and Grit. By *S. L. Tolman*, Jeffrey Mfg. Co. October, Pp. 61-63, 96, 98.
Design Data and Equipment for Sedimentation. By *J. J. Gilbert*, Link-Belt Co. October, Pp. 64-66, 94, 96.
What You Should Know About Sludge Digestion. By *Harry E. Schlenz*, Pacific Flush Tank Co. October, Pp. 67-71, 98, 100.
Designing Activated Sludge Treatment Plants. By *Miles Lamb*, Chicago Pump Co. October, Pp. 72-74, 118.
How to Design Trickling Filters. By *R. S. Rankin*, Dorr Co. October, Pp. 75-77.
Activated Sludge for Sewage and Waste Treatment. By *A. A. Kalinske* and *H. W. Gilard*, Infilco. October, Pp. 78-81, 120, 121.
Selecting and Installing Pumps for Sewage and Sludge. By *James B. Neighbor*, Chicago Pump Co. October, Pp. 82-84, 92, 94.

The Surveyor (England)

Design for Extensions to the Rodbourne Sewage Works, Swindon. By *H. T. Coggon*, Prin. Asst. Borough Surveyor. Sept. 15, Pp. 585-587.

Sewage and Industrial Wastes

Measurement of Sludge Drying Bed Performance. By *T. R. Haseltine*, Cons. Engr. September, Pp. 1065-1083.

The Effect of Ultrasonics on Suspended Matter in Sewage. By *Walter A. Lyon*, Asst. San. Engr., U.S.P.H.S. September, Pp. 1084-1095.
Design of Palmer-Bowlus Flumes. By *John H. Ludwig* and *Russell G. Ludwig*, Cons. Engrs. September, Pp. 1096-1107.
Statistical Summary of Grit Chamber Usage as Related to Type of Sewer System. By *John R. Thoman*, San. Engr., U.S.P.H.S. September, Pp. 1108-1112.
Ground Garbage Studies at Detroit. By *Clyde L. Palmer*, San. Engr., and *Isadore Nusbaum*, San. Chem., Sew. Treat. Plant. September, Pp. 1113-1117.
Salmonella in Irrigation Water. By *S. G. Dunlop*, Asst. Prof. of Bacteriology, and *R. M. Twedt* and *Wen-Lan Lou Wang*, Assts., Univ. of Colorado. September, Pp. 1118-1122.
Materials Chief Cost in Building New Sewage Works. September, Pp. 1123-1124.
Color in Industrial Wastes: Determination by Spectrophotometric Method. By *Willem Rudolfs* and *William D. Hanlon*, N. J. Agri. Exp. Sta. September, Pp. 1125-1132.
Waste Treatment Developments in the General Electric Company. By *Kenneth S. Watson*, Coordinator of Waste Treatment. September, Pp. 1133-1140.
Determination of Dissolved Oxygen in Industrial Wastes by the Winkler and Polarographic Methods. By *M. C. Rand* and *H. Preukelekian*. N. J. Agri. Exp. Sta. September, Pp. 1141-1149.
Ozonation of Cyanide Wastes. By *Richard G. Tyler*, Prof. of San. Eng., *William Maske*, Chem., and *M. J. Westin* and *Willard Matthews*, Fellows. Univ. of Washington. September, Pp. 1150-1153.
A Comparison of Enterococci and E. Coli as Indices of Water Pollution. By *William E. Lattanzi*, San. Inspector, and *Eric W. Mood*, Lecturer on Pub. Health, Yale Univ. September, Pp. 1154-1160.
Relation of B.O.D. to Stream Deoxygenation. By *Walter E. Williams*, San. Engr., U. S. Rubber Co. September, Pp. 1161-1175.
Operation and Maintenance of New York City Sewage Treatment Plants. By *Nathan J. Kass*, Chf. Sew. Disp. Operation, *Wilbur N. Torpey*, Engr. Sew. Treat., *A. H. Chasick*,

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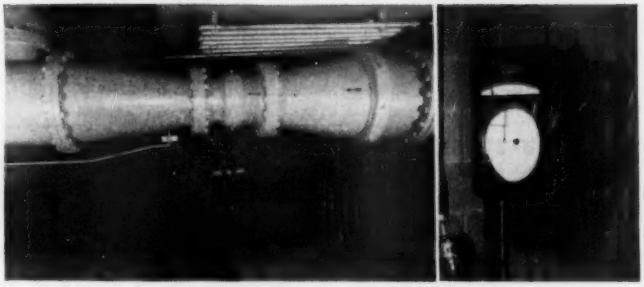

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Asst. Engr., *Richard C. French*, Eng. in Charge of Mech. Equip., and *E. W. Luft*, Eng. in Charge of Electrical Equip. September, Pp. 1176-1198.

South African Municipal Magazine

Sewage Research in South Africa. By *E. J. Hamlin*, Former C. E. of Johannesburg, and *H. Wilson*, Advisory Off., S. A. Council for Sci. & Industrial Research. August, Pp. 81, 83, 85, 87.

Water & Sewage Works

Industrial Wastes: "A Worm's Eye Viewpoint." By *L. L. Hedgepeth*, Am. Cyanamid Co. September, Pp. 392-393.

Flash Drying and Incineration. By *Frank L. Flood*, Cons. Engr. September, Pp. 394-398.

Corrosion of Cement-Bonded Sewer Pipes. By *Harvey F. Ludwig* and *Russell G. Ludwig*, Cons. Engrs. September, Pp. 404-407.

The Strawboard Waste Problem. By *Don E. Bloodgood*, Prof. San. Eng., Purdue Univ. September, Pp. 408-412.

Battle Creek Sewage Plant Produces New Product. By *Robert R. McIntosh*, Dir., Dept. of Pub. Wks. October, Pp. 413-415.

Storm Water Pumping Stations Solve Corpus Christi Problems. October, Pp. 416-417.

Solution of Manning's Formula. By *J. P. Messina*, Engr., Worthington Pump & Mach. Corp. October, P. 419.

The Savannah Sewer Story, 1847-1951. By *Henry W. Jenkins*, Supt of Constr. & Maint. October, Pp. 426-428.

Wastes Engineering

Tale of Two Cities—Retold (Minneapolis-St. Paul). By *Kerwin L. Mick*, Chf. Engr., Minneapolis-St. Paul San. Dist. October, Pp. 527-529, 566-567.

Industrial Dispersal Increases Wastes Problem in Indiana. By *Perry E. Miller*, Div. of San. Eng., Indiana State Bd. of Health. October, Pp. 530-534.

By-product Recovery Features Illinois Wastes Progress. By *A. Paul Troemper*, San. Engr., Ill. San. Water Bd. October, Pp. 534-537.

Dairy and Food-Processing Wastes Predominate in Minnesota. By *Wm. J. Uber*, Asst. Engr., and *Harvey G. Rogers*, Dir. of San., Div. of Water Pollution Control. October, Pp. 538-540.

Wisconsin's Stream Pollution Control Program. By *T. F. Wisniewski*, Dir. Water Pollution Control, and *O. J. Muegge*, State San. Engr. October, Pp. 540-543.

Treatment Works Needed in Upper Mississippi Great Lakes Drainage Basins. By *Paul W. Reed*, San. Engr., U.S.P.H.S. October, Pp. 543-544.

Indiana, Illinois Need 311 Sewage-Wastes Plants in Ohio-Lake Erie Drainage Basins. By *W. W. Towne*, U.S.P.H.S. October, Pp. 545-546.

How Some Operation Problems Were Solved at Gary Plant. By *W. W. Mathews*, Supt. Sewage Treat. Wks. October, P. 547.

Occupational Hazards Studied in Sewage Treatment Plants. October, Pp. 548, 569.

Foot Accident Protection for Refuse Collectors

Refuse collection crews sometimes suffer from foot punctures due to nails, glass, scrap metal, etc. The National Safety Council undertook to collect information on remedies, but found no unanimity of opinion. Protective undersoles would solve only that part of the problem due to punctures directly through the bottom of the shoe. The best present solution was considered to be insistence on wearing high-topped, field-type work shoes of rugged construction, and that the shoes be kept in repair.

Turbine Pumps

(*Continued from page 50*)

from basic considerations which clearly show functional advantages or disadvantages. The fully enclosed type of impeller is well-known for its general stability during extended wear, hydraulic balance which is more favorable to thrust bearing, and for being insensitive to axial adjustment over the normal pumping range.

The semi-open impeller allows careful finishing of the passages but is quite dependent upon close running clearance to minimize circulation losses. The clearance is subject to fluctuation as the head changes over the pumping range and this necessitates adjustment for the maximum head with subsequent penalty of circulation loss for the minimum head.

The correct size of the column pipe should be determined by comparisons on the basis of initial cost and power cost (kwh per 1000 gallons) due to the change in friction losses.

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portant element of the system and deserves careful thought. The horizontal or vertical steam turbine can be used where the range of head capacity dictates extremes of speed. The turbine and pump have similar torque characteristics and are effectively coupled. A typical graph of the horsepower versus RPM of a steam turbine is shown in Figure 6.

For lesser speed ranges, the gas or diesel engine has useful flexibility and both vertical and horizontal types are available. This type of drive requires a suitable clutch which can be supplemented to advantage by hydraulic couplings or gears. Figure 7 shows general performance characteristics.

Probably the more common drive which is most readily adaptable to full automatic control is the electric motor. This may be either the induction or synchronous type. As with the other drives, the pump torque characteristics are easily adapted. Note from Figure 8 that the motor efficiency in terms of output horsepower is broad and combines to advantage with the turbine pump for extreme changes of head capacity even though the choice of speeds may be more restricted. Efficiency and power factor can be improved by the use of the synchronous motor, but there is a low limit of horsepower below which it is not economical.

Delivery Piping

The delivery piping with the various fittings and flow devices completes the load system and warrants thorough investigation. Dimensional data such as elevations, lengths, and tentative diameters should be represented in suitable graphic form which can be considered with such other factors as shock and friction losses and the effects of age or deposits on the total investment and operating expense. Thus, an oversize pipe system may be a saving when properly amortized.

For most demands, a net quantity (gallons or cubic feet) of water is the useful form and any added power to develop pressure or velocity is intangible. For example, a plant which delivers large quantities at low levels and maintains simultaneously a small quantity at an extreme high elevation or pressure reflects serious waste of power due to the large quantity and high pressure. An auxiliary plant for this small quantity would be preferred.

The effective and safe operation of the total plant is dependent on suitable devices and controls. The well and pump should be protected and guided by floats or other level detectors. Lubrication controls should be provided for the shaft bearings and in the case of open line shaft type of column, the device should prelubricate and postlubricate during the starting, stopping and reversing phases. The antireverse ratchet can be used to some advantage if no reversal can be permitted.

Speed controls are necessary for drives other than electric motors of the induction type and should be coupled with suitable pressure devices for stabilizing the system. Overload protection is provided for the electric drive for such typical conditions as sand locking or interference due to sticks, stones, or other obstructions at the impeller. Whether these devices should be fully automatic or manual depends upon the size, location or use of the plant. Valuable supplements to the pumping plant are recording devices for the flow quantity and rate, discharge pressure and other levels, and power measurements.

HOW TO BUY A VALVE

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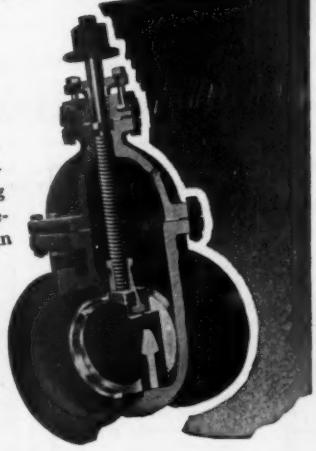

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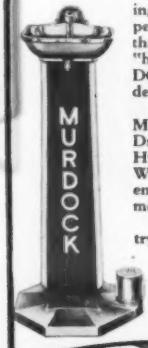

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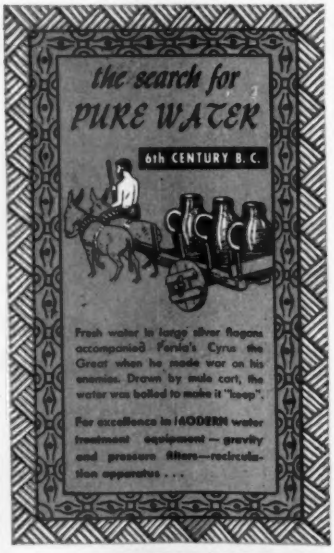
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These will aid the supervisor in decisions affecting the total plant.

The total plant becomes a serviceable unit when the components are combined to operate within the prescribed limits. The factors of quantity, pressure, power, time and materials are summarized for the economical range and safe operation as shown in Figure 5. The use of the system beyond these limits clearly shows the waste of the power dollar and the possible abuse of the well, pump or drive.

The constructive supervision of such an investment requires judgment and experience and is greatly augmented by carefully kept records of the pumping quantities, time, cost and the manhours required for repair or replacement. This information should be supplemented by a current record of books, notes, papers, sketches and drawings pertaining to the components. From this background a thoughtful decision can be made, for example, to add more units instead of overloading the existing ones, to repair the old equipment or to replace with modern equipment.

The successful operation of the pumping plant implies an obligation to management, to the invester and to the consumer. This means a proper choice of equipment based on sustained high performance and due regard for the basic features of design.

Prestressed Concrete Road

The concrete surfacing of a short road under construction at Crawley, Eng., includes an experimental prestressed bay 400 ft. long. The amount of prestressing (200 lb/sq. in.) is the minimum required to neutralize the estimated subgrade restraint and to provide a residual prestress of about 100 lb/sq. in: the latter amount is insufficient to obviate cracking under thermal or traffic stresses, but enough to ensure the rapid closing of any cracks. A short expansion bay of hardcore covered with a tarmacadam wearing course was laid at each end, being separated from the slab by 2 in. of expansion jointing material; when the amount of expansion has been measured an expansion joint of suitable width will be provided. Observations of slab movement and of internal stresses are being carried out by the Road Research Laboratory, Harmondsworth. — The Surveyor, condensed in Road Abstracts.

PUBLIC WORKS DIGESTS

THE HIGHWAY AND AIRPORT DIGEST

Bridge Deck Of Precast Slabs

A two-lane bridge with two 2½ ft. sidewalks, totaling 29 ft. width, 400 ft. long, supported on 5-pile concrete bents spaced 15 ft. on centers, was built by the Florida State Road Dept. at a cost of only $82.50 per lin. ft. for the superstructure. This low cost is mainly attributable to the use of precast concrete slabs. Each roadway slab is 5 ft. 4 in. wide, 15 ft. long and 10 in. thick, reinforced longitudinally with ¾ in. bars 5 in. on centers at the bottom and ½ in. bars 20 in. apart at the top. After being cast and cured, the slabs were picked up by a 10-ton truck crane, transported to the bridge and set on the pile bents, four rows with 10 in. spaces between them. These spaces were filled with concrete after the slabs had been checked for alignment and grade.

V. R. Gorham—"Precast Slabs Make Low-Cost Bridge;" *Engineering News Record*, Oct. 4.

Soil Maps Aid Highway Location

Drainage and engineering soil maps are valuable aids in the selection of highway locations between fixed termini. They are also helpful in the location and design of drainage structures, and provide useful information on soils and other construction materials and on terrain conditions, needed by the engineer in the planning of highway design and construction.

Lacking accurate published maps, aerial photographs provide an excellent base for the preparation of the drainage and soil maps. The proper interpretation of landform, airphoto color tone, drainage characteristics, and other physical features of the aerial photographs, when studied stereoscopically, reveals a great deal about the soil and terrain conditions of the area, particularly when correlated with field investigations and study of available information on the geology and soils of the area.

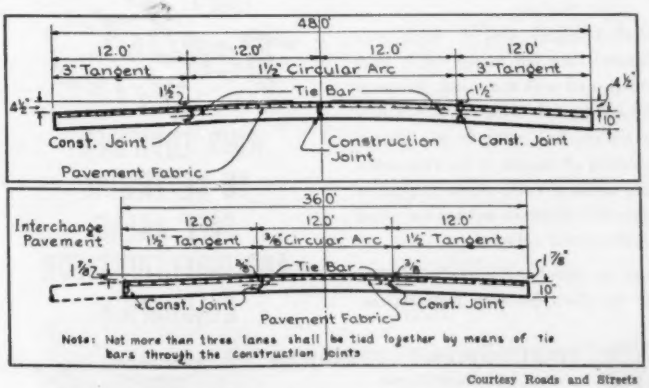
The Bureau of Public Roads studied a section of the Natchez Trace Parkway, which extends from Nashville, Tenn. to Natchez, Miss., to provide information on soil and terrain conditions, and also to investigate the technique of air-photo interpretations of such conditions and the preparation of engineering soil strip maps.

Preston C. Smith—"Appraisal of Soil and Terrain Conditions for Part of the Natchez Trace Parkway;" *Public Roads*, October.

Concrete Paving On Edens Expressway

Edens Expressway, which enters Chicago from the North and is 13½ miles long, is expected to be open to traffic by the end of the 1951 construction season. It is built on a 300-ft. minimum right-of-way; consists of two pavements of three 12-ft. lanes each, separated by a median strip 12 to 35 ft. wide. The main roadway consists of 10 in. uniform thickness reinforced portland cement concrete on 6 to 12 in. of granular blanket. Doweled transverse contraction joints are spaced every 100 ft., with no dummy or expansion joints. Colored concrete is being used for on and off ramp paving, to warn and divert drivers.

Special attention has been given to securing highest quality in concrete pavement construction. A slump of 1 in. to 1½ in. is required. Concrete forms are required to have a base width of not less than 10 in. and be at least ¼ in. thick, because of the heavy equipment to be carried. Contractors are required to use a mechanical spreader equipped with a vibrating pan, which is believed to be the best equipment available for satisfactory placement of a relatively low-water-cement-ratio concrete. This, followed by a mechanical finisher, longitudinal power float and long-handled hand float has resulted in exceptionally uniform, dense concrete. Vibrating screeds are required at ramps and on special sections where vibratory spreaders and mechanical finishers cannot be used. Contractors are required to remove the curing cover on selected sections the morning following placement of the concrete to permit the engineers to test for surface evenness. A smoothness tolerance of ⅛ in. in 10 ft. is specified.



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● **CONCRETE paving for Edens Expressway.**

Exceptionally rigid inspection and control of aggregates are insisted upon, to insure against segregation in stock-piling and handling. One contractor simplified this by using the latest high-accuracy, automatically controlled weighing equipment (Blaw-Knox). The soil throughout the entire length was investigated by means of sub-grade hand auger borings at intervals of 300 to 25 ft., carried to a depth of 6 ft. below pavement grade. This located a peat area, and work of consolidating this was begun about a year prior to paving operations; a combination surface and subsurface drainage system was constructed and embankment loads superimposed. This seems to have produced satisfactory consolidation.

William J. Mortimer—"Quality Concrete Paving on Chicago's New Edens Expressway;" *Roads and Streets*, September.

Economy in Stockpiling Aggregate

An estimated 900,000 to 1,000,000 tons of crushed trap rock for penetration base and hot mixed asphaltic concrete is being hauled this year from a quarry at Bound Brook for construction of the New Jersey Turnpike. The maximum length of haul is 64 miles, to the southern end of the job; the minimum is 20 miles. The contractor for hauling this decided to stockpile 90% of the penetration stone and all of the hot mix stone; believing that stockpiling and rehandling are more economical than attempting to syncronize hauling with paving operations. Also, maximum use can be made of good hauling weather and periods of good crusher operation. Rehandling for base construction is being done with clamshells, draglines, shovels or loaders, into smaller trucks which are more easily maneuvered at the paving operation.

The hauling contractor uses about 63 trucks. The drivers are carefully briefed on traffic regulations and company safety rules. No heaped loads are allowed to go out, to avoid spillage. Freeboards 2 ft. high have been welded on many truck bodies to permit full loads without spillage. To keep the truck fleet in condition, there are two heavy-duty tire service trucks, two 6-reel grease and lube trucks, a wrecker, and a well equipped repair shop. A magnet truck "de-nails" the haul route. At 5 P.M. most of the trucks are parked for nightly servicing, which is given by a 4-man servicing crew.

"Brewster's Big Stone Trucks;" *Roads and Streets*, September.

Resurfacing Heavily Traveled Streets

The 500 miles of streets in Manhattan Borough, New York City, are completely paved, approximately 4 million yards with stone block and more than 8 million yards with sheet asphalt. The latter generally last 15 to 20 years, and are then replaced by contract or resurfaced by the city's maintenance forces. At the height of the resurfacing season there are four gangs, some 12 men for asphalt repairing, and 24 men for resurfacing supplied with a large 8 x 8 surface heater, rollers, trucks and other equipment. Hot material is furnished by a municipal asphalt plant which has a rated capacity of 700 tons a day but on a recent rush job furnished 1140 tons in a 10-hour day. Resurfacing is done in the standard way, the old surface being heated and scraped with rakes and new hot material spread and rolled. In normal years 250,000 to 300,000 yards of resurfacing is done.

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The most important part of the operation is so staging it as to cause least interference with traffic, which is very heavy. Generally on the narrow 60-ft. roadways the full width is done in one operation. Working from one end of a block, access and egress are permitted from the other end; and as the resurfacing proceeds through the block, traffic follows on the new surface. On the 100-ft. streets, only one half of the width of the street is done at a time.

Harry W. Levy—"New York's Asphalt Resurfacing Practice;" *Public Works,* October.

Snow Fighting in Washington State

The Washington Dept. of Highways last winter spent $1,493,157 for snow removal and ice control, chiefly in keeping open three of the four passes through the Cascade Mountain Range. The fourth pass, Chinook, is left impassable from November 1 to June 1. The most important pass is Snoqualmie, which carries an average of 3200 vehicles a day. The snowfall here has ranged from 333 in. to 631 in., and the depth in the pass has ranged from a low of 66 in. to a high of 280 in. The most hazardous and difficult condition is that caused by warm winds and driving rains which cause snowslides which cover the roadway 6 to 20 ft. deep and bring down rocks and timber. Water flowing down between the snow banks washes off the sand and salt and forms an extremely slick and river-like roadway, which becomes a mushy mass 8 to 12 in. thick.

A snow camp is maintained at the summit of the pass, occupied throughout the winter by a crew of 30 to 40 men. For handling the snow, the larger 5-ton dump-truck pushplows are being replaced with 2-ton and 2½-ton 4-wheel-drive trucks because of the higher speed possible. A larger number of heavy power graders are being used in an attempt to eliminate packed snow and ice bottom on the roadway. Each year larger quantities of sand are being used. The sand piles at Snoqualmie summit are protected by a sand shed 91 x 36 ft., where two hot-air blowers keep the sand from freezing.

K. G. Miller—"How Washington State Road Crews Keep Passes Cleared;" *Roads and Streets,* September.

Economizing by Use of Equipment for Maintenance

New York State Dept. of Public Works is reducing the cost of maintaining its highways by use of recent improvements in the design of maintenance equipment. Many of these have direct application over a wide field of maintenance work, enabling savings in man-hours, eliminating much drudgery, improving results, and making possible quick completion of many jobs that previously have had to be slighted. The list of improved machines includes loading and excavating devices of several types; graders and dozers; new ideas in mowers and brush-cutters; traveling, portable and stationary mixers; traffic-line stripers; shoulder-stabilizing machines; trench excavators, backfillers and rollers; equipment for spreading abrasives and salt, and driers for stone and other aggregates. The savings resulting from the use of any one of these units are not startling; but collectively the benefit has been substantial.

V. L. Ostrander—"New York Looks to Improved Machines and Revised Methods;" *Better Roads,* September.

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BIBLIOGRAPHY

Better Roads

New York Looks to Improved Machines and Revised Methods. By *V. L. Ostrander*, Supt. of Operation & Maint. September, Pp. 21-22.

Use of Bituminous Overlays Found Economical in Illinois. By *C. W. Ross*, Engr. of Maint. September, Pp. 22-24.

Maintenance is Concern of All Divisions of Department. By *Lindsay F. Root*, Asst. Admin. Engr., New Mexico H'way Dept. September, Pp. 24, 35.

Missouri Mechanics Build a Roughometer. September, Pp. 29-30.

County Engineering Soils Maps in Illinois. By *Thomas H. Thornburn*, Research Asst. Prof. of C. E., Univ. of Illinois. September, Pp. 38-39.

Engineering News-Record

Precast Slabs Make Low-Cost Bridge. By *V. R. Gorham*, Contractor. Oct. 4, P. 37.

Public Roads

Appraisal of Soil and Terrain Conditions for Part of the Natchez Trace Parkway. By *Preston C. Smith*, H'way Phys. Research Engr., B.P.R. October, Pp. 193-205.

Freezing and Thawing Tests of Concrete Containing Oregon and Washington Aggregates. By *A. G. Timms*, Sr. Materials Engr. October, Pp. 206-216.

Public Works

Snow Shed Protects Cascade Highway. By *Ray Bloomberg*. October, P. 54.

New York's Asphalt Resurfacing Practice. By *Harry W. Levy*, Dep. Chf. Engr. October, Pp. 59-60.

Oil Mat Resurfacing for Improved Streets. By *John R. Hamman*, City Mgr., Chickasha, Okla. October, P. 60.

Roads and Road Construction (England)

Prestressed Concrete Pavements. By *W. P. Andrews*. September, Pp. 249-252.

Roads and Streets

Brewster's Big Stone Trucks. September, Pp. 35-38.

Quality Concrete Paving on Chicago's New Edina Expressway. By *William J. Mortimer*, Asst. Supt. of H'ways, Cook Co., Ill. September, Pp. 41-45.

How Washington State Road Crews Keep Passes Cleared. By *K. G. Miller*, Ass't H'way Engr., Dept. of H'ways. September, Pp. 46, 48, 50.

The Maryland Asphalt Extractor. By *J. Eldredge Wood* and *William T. Long*, Materials Dept., Maryland Road Com'n. September, Pp. 60-62, 78.

Qualitative Review of Minnesota's 1950 State Highway Bituminous Program. September, Pp. 64-65, 68-69.

Requires Off-Street Parking

Fair Lawn, N. J., which has a population of 23,865, recently adopted an ordinance requiring off-street parking facilities in business, light industry, and industrial zones. Structures designed for retail and wholesale establishments are required to provide two square feet of parking area for each square foot of usable net floor area, with an alternate method being one and one-half square feet for each square foot of gross floor area. Buildings for office and professional quarters must provide space for one vehicle for each 150 square feet of floor area. The parking areas must be paved and properly drained.—Public Management.

Pavement Design

(*Continued from page 42*)

liable results than any procedures in this group.

The design method suggested by Burmister, based on his analysis, considers, for a flexible pavement, the surfacing, base and subbase as the top layer and the subgrade as the bottom layer. The thickness of the top layer is so selected that the displacement under the wheel load is limited to an arbitrary quantity. Burmister suggested 0.2 in. for flexible pavements as a tentative basis. Design curves are shown in Fig. 4 for flexible pavements. For rigid pavements, Burmister considers three layers—concrete slab, base and subbase. The thickness of concrete is selected according to wheel load and experience of the thickness required to meet secondary stresses. The thickness of the base is then selected so that the displacement under the wheel is limited to a desired value, as 0.05 in. Tentative design curves for rigid runway pavements are shown in Fig. 5. In general, this method is not really practicable in its present form, but is likely to prove useful in the development of future methods in this group. Reference to Figs. 4 and 5 will show that this method indicates for a 37,000-lb. wheel load, a subgrade modulus of 3,000 lbs./sq. in., and a well-graded gravel base, a total thickness of flexible surfacing and base of 16 ins., whereas with a 7-in. concrete slab, an additional base thickness of 18 ins. is needed. This hardly agrees with experience.

Additional methods or work done in this field is that by Palmer and Barber and the extension of Burmister's work by the National Physical Laboratory for the Road Research Laboratory. However, even when a sound theory of stress distribution has been developed there is still the problem of how to measure the strength properties of the various materials for utilization in such a theory, since the measured strength must consider such factors as load repetition, traffic distribution and changes in moisture content of materials.

Discussion and Conclusions

As yet, there are no generally accepted methods of designing pavements comparable with the methods used in other branches of engineering. In fact, even the most reliable methods of pavement design provide only an approximate estimate of the thickness of different types of construction required. There are a large number of different design methods—certainly more than thirty—in use by different authorities, and many of these methods have little in common either in the assumptions they make or in the results they produce. However, it is possible to classify all design methods roughly into four groups; two for wholly empirical methods, one for semi-empirical methods and one for wholly theoretical methods.

It is thought that the most reliable methods at the moment are:

(a) The California bearing ratio method for flexible pavements.

(b) The shear strength method for pavements on clay subgrades. This method is probably less reliable than the California Bearing Ratio method but uses a simpler test. Some modifications to the original method are necessary.

(c) Teller and Sutherland's modifications to Westergaard's analysis for calculating the stresses in concrete pavements due to traffic loads and Thomlinson's theory for calculating the stresses due to temperature changes.

Developments in the immediate future which would probably be of most use to British engineers are:

(a) Improvements in the technique for estimating the critical moisture content of the subrade once an impermeable pavement has been constructed so that the strength of the subgrade soil may be determined under the correct critical conditions.

(b) Further modifications to the California Bearing Ratio method to suit British conditions and dispensing with the soaking procedure except under special conditions. As the result of further experience and experiment with this method, it may be possible to deduce sets of curves which give required thicknesses of construction for different types of flexible construction.

Long-term researches in design should eventually produce a reliable Group D method. The beginnings of such a method can be seen in the elastic two-layer stress and strain analyses. Modifications to take account of the non-elastic behavior of soil and road materials are probably necessary. Test procedures may well include repetitional triaxial testing to determine the full strength and deformation characteristics of the materials.

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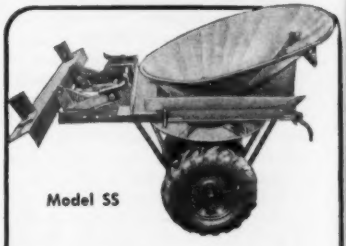

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PUBLIC WORKS DIGESTS

THE WATER WORKS DIGEST

Water Use In Industry

Approximately 25% of the nation's daily water use is in industry. The largest part of this is accounted for by the relatively few industrial plants that use exceptionally large amounts of water. The increase in the scale of industrial operations over the past ten years has been partly responsible for the increased use of water by industry. Among industrial plants, the most important use of water is for process purposes, except that cooling water is the most important use in the large water-using plants. About 50% of the plants investigated have their own facilities for treating water—more large plants than small ones. Also a larger percentage of large than of small plants treat their waste waters. Among plants making the same products, some use 2 to 10 times as much water per unit as others.

Roy R. Green—"Water Use In Industry"; *Journal American Water Works Association*, August.

Adding Industrial Customers

When adding a relatively large customer to its system, a water utility must make certain that it will earn a good return not only in the pipe line and appurtenances needed to connect the new industry to existing lines, but also on additions that will eventually be needed at its plant in the way of pumps, filters and other facilities. The Indianapolis (Ind.) Water Co. found in 1926 that the amount invested in pipe lines was 39.5% of the total value of the plant; at the end of 1949 it had increased to 45.9%, but will probably fall again to about 40%. Therefore, the system will eventually have to absorb not only the cost of the new main, but 1½ times as much in addition in other facilities, or a total of 2½ times the cost of the new main. About 50% of the operating revenues is absorbed by operating expenses; therefore the revenue should be the percentage return desired, based on 5 times the cost of the new main, or say 30% of such cost.

Alfred O. Norris—"Considerations Involved in Adding Industrial Customers to Public Water Supply Systems";—*Journal American Water Works Association*, August.

Multicontrols At Jamaica, N. Y.

The Jamaica Water Supply Company operates in a 40-sq. mi. area with a population of over 475,000. Water is obtained from 55 wells with a capacity of 72 mgd, and distributed by 29 pumping stations through 735 miles of mains. Storage is furnished by 22 tanks. To coordinate the operation of these many units, the company has developed a combination of controls consisting of automatic pressure and clock-controlled stations, automatic pressure-controlled interconnection stations, and a load-dispatching base station with facilities for mobile radio communication and telemetered gauge readings from all areas and for telemetered operation of four elevated tanks at remote critical areas. In the residential area the hourly peak is 300% of average daily pumpage, and the maximum summer day is more than 150% of the average. It is necessary to so operate the system as to meet these two maximum demands. The storage capacity, totaling 19 mg, is given maximum effectivness for use on daily peaks by telemetering of pressures, and operation of the tank discharge valves by the telemetering equipment. The well and storage facilities are located at 33 points. At three of these, attendants are on duty 24 hrs. a day; equipment at all the others is operated by three groups of attendants who visit each at 4-hr. intervals to service and operate them. One base station is the operating nerve center of telemetering and of radio communication with the supervisory staff. Pressures from 8 points are transmitted to gauges at this station. Two stations are fully automatic. One is a well, ground tank and booster station controlled by a time cycle to deliver daily peak load requirements as necessary. The costs of the control system are negligible compared to the investment in the production and storage facilities involved, and their utilization saves additional large capital expenditures and insures continuity of service.

J. Reid Hobson and Peter Ley—"Supply and Storage Facilities Coordinated by Multicontrols;" *Water Works Engineering*, September.

How Madison, Wis. Reduced Costs and Increased Revenues

For thirty years following 1918, in spite of rising costs, Madison's water plant operated without increasing rates. There were six basic reasons for this: 1—Increased efficiency of pumping equipment; 2—Substitution of mechanical equipment for hand labor; 3—Automatic well pumping stations; 4—Changing from steam to electric pumping. 5—Increased number of consumers per mile of main. 6—In some respects the most important, reduction of unaccounted-for water. All services to private consumers have always been metered. Public consumption was not metered originally, but by metering has been reduced from 11.8% of the total pumpage to 2.2%. Water consumed in operation was reduced from 7.8% to 4% by eliminating need for condensing water with substitution of electric for steam operation, and by reducing iron content of water from 2 ppm to 0.02 ppm, and thus reducing the amount of flushing necessary. Meters were put into condition to register at least 90% at ¼ gpm or junked; and leaks were located and repaired. As a result, unaccounted-for water has

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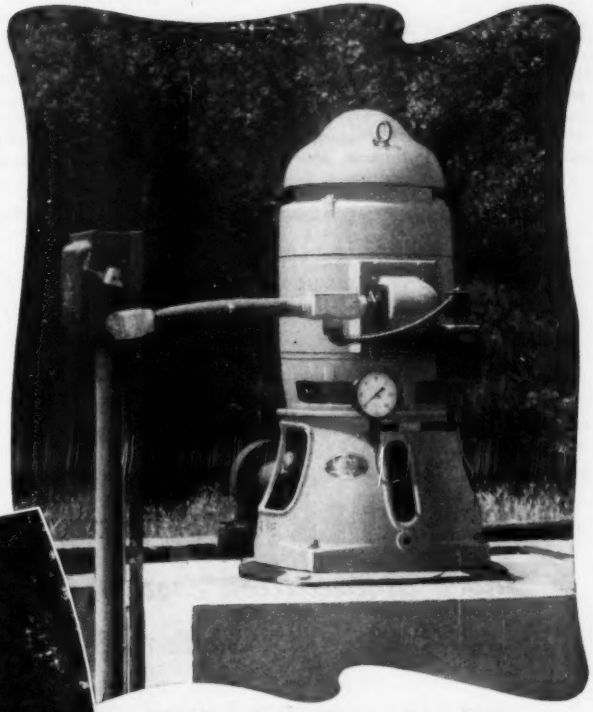
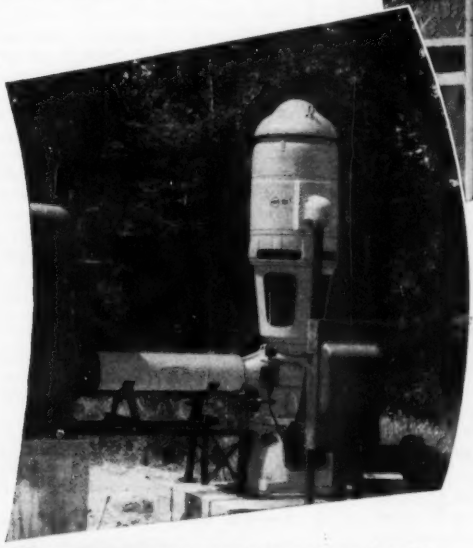
TOMS RIVER, New Jersey

. . . WITH her population more than doubling during the summer season, the resort city of Toms River, New Jersey, was facing a serious water shortage problem. Five old, inefficient and not too dependable wells were being operated with suction pumps. Layne was called in for a discussion of what could be done with limited funds. Layne's recommendations resulted in a contract for the rebuilding and re-equipping of one old well and the drilling and equipping of a new one. The contract also called for equipping one pump with an auxiliary, gasoline engine drive, on one of the pumps, for use in case of electric power failure. Without delay everything was finished according to the contract, giving the city of Toms River a water supply that more than fulfills present needs. The new equipment also greatly reduced operation cost which more than justified the investment.





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Everything, with the exception of some wiring for the Toms River job was handled complete by Layne in one inclusive contract. Each phase of the work was under the supervision and direction of Layne engineers who made sure that all materials and method of installation were up to Layne's very exacting standards. The entire job handled in one contract was an important factor in saving time, extra expense and unnecessary worry for the Toms River city officials. Furthermore it assured the city of obtaining a completely satisfactory job throughout.

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been reduced from 23% to 4.2%, and the cost per 100 cu. ft. sold from 6.5¢ to 4.2¢.

L. A. Smith—"Reducing Unaccounted-for Water and Its Effect on Water Rates"; *Water Works Engineering*, September.

Standpipe vs. Elevated Tank at Madison

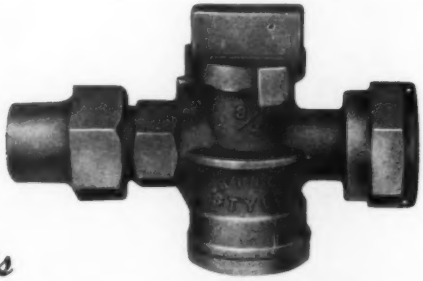
The Madison, Wis., water department in 1927 built a 6 m.g. high-service reservoir in the western part of the city, with a top elevation 200 ft. above the pumping station. Recently it became desirable to provide elevated storage in the eastern part of the city, which also should rise 200 ft. above the pumping station, or 100 ft. above the highest location available, in order to float on the system. A capacity of 1 m.g. was decided upon. An elevated tank on a tower was estimated to cost $132,000 plus $8,000 for the foundation. An alternative which was studied was a standpine of 3 m. g. capacity, the upper third of which would serve the same purpose as a 1 m.g. elevated tank. The cost of this, including foundation, was $167,000 or $27,000 more than a tank. To offset this, the bottom 2 m.g. could be made available by installing, at the standpipe, a stand-by gasoline pumping unit costing less than $5,000. In this way the bottom 2 m.g. is made avavilable for emergency use at a cost of $32,000. Calculating in another way, the cost of storing in the standpipe per m.g. is $57,300 as compared to $140,000 in the elevated tank. The standpipe is 73 ft. in diameter and 100 ft. high, of ¼" to 2" steel plates electrically welded.

Leon A. Smith—"New Standpipe at Madison, Wis." *Water and Sewage Works*, September.

The Ideal Lime-Softened Water

In an effort to determine the composition of an ideal, noncorrosive and nonscaleforming water, the author sent questionnaires to 36 municipalities that use lime-softened water. He found that at least 9 of the waters can be improved by a revised treatment to provide a better balanced water. An attempt was made to define a range of proper chemical balance which will minimize corrosion and incrustation. He believes that it is more desirable to produce waters with a low saturation pH than with a high one. A positive saturation index is invalid if there is not sufficient calcium or alkalinity present to provide a scale-forming film, or if magnesium reduces the pH by precipitation of the hydroxyl ions on heating. Precipitation of magnesium hydroxide may occur within hot water heaters and the precipitate may be carried into hot-water lines and deposited there. For an extensive distribution system, probably the water should have an alkalinity of at least 50 ppm and preferably 100 ppm, and a pH not above 8.2-8.5.

T. E. Larson—"The Ideal Lime-Softened Water"; *Journal American Water Works Association*, August.



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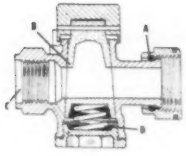

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BIBLIOGRAPHY

American Water Works Ass'n. Journal

Water Rates: Committee Progress Report. September, Pp. 665-671.

U.S.P.H.S. Position on Fluoridation of Public Water Supplies. By *H. Trendley Dean*, Dir., Nat'l Inst. of Dental Research. September, Pp. 672-674.

Compensation of Water Works Personnel: Preliminary Committee Report. September, Pp. 675-680.

Water Supply Notes on the Kansas Flood. September, Pp. 681-688.

Meter Maintenance Costs. By *A. P. Kuranz*, Mgr. Water Utility, Waukesha, Wis. September, Pp. 689-693.

Seasonal Water Demands in Vacation Areas. By *S. K. Keller*, Gen. Supt. Pinellas County.

Fla. Water System. September, Pp. 694-704.
Meter Reading and Commercial Department Operation. By *Kenneth K. King*, Dir. Pub. Wks., Phoenix, Ariz. September, Pp. 705-712.
Drawing Water From a Dune Area. By *Pieter C. Lindenbergh*, Dir. of W. W., Leyden, Netherlands. September, Pp. 713-724.
Analytical Instruments Used in the Modern Water Plant Laboratory. By *S. K. Love*, Chf., Quality of Water, U. S. Geolog. Surv. September, Pp. 725-740.
Relation of Water Utilities to State Regulatory Bodies. By *Spencer B. Eddy*, Com'r, State Pub. Serv. Com. of N. Y. September, Pp. 741-743.
Fluoride Chemical Feeding. By *L. E. Harper*, Pres. Omega Machine Co. September, Pp. 744-762.
Copper with Ammonia and Chlorine in Finished Water. By *Marsden C. Smith*, Chf. Water & Research Engr., Richmond, Va. September, Pp. 763-769.
Well Construction and Operation. By *Paul Schweitzer*, Pres. Layne-Atlantic Co. September, Pp. 770-772.

Engineering News-Record

Houston Plans an Open-Air Waterworks. Sept. 27, P. 62.
New Concrete Pipe Techniques Developed for Central Valley Distribution Works. Oct. 11, Pp. 34-37.

New England Water Works Ass'n Journal

The Water Supply Situation in New York City in 1950. By *Edward J. Clark*, Chf. Engr., Bureau of Water Supply. September, Pp. 203-210.
Technical Investigations of Additional Ground Water Supplies in Rhode Island. By *William B. Allen*, Geologist, U. S. Geological Survey. September, Pp. 211-216.
Peak Demaad Loads in Water Supply Systems. By *William J. Stanley*, Prof. of San. Eng., M.I.T. September, Pp. 217-248.
Present-Day Uses of Cone Valves. By *Carl J. Wilcox*, S. Morgan Smith Co. September, Pp. 249-255.
Sanitary Protection of Watersheds: Are We Overdoing or Underdoing It? By *Arthur D. Weston*, Cons. Engr. September, Pp. 256-285.
Water Supply Developments in the Other American Republics. By *Clarence J. Sterling, Jr.*, Chf. San. Engr., Mass. Dept. of Public Health. September, Pp. 286-291.
The Construction of Spherical and Radio-Cone Elevated Tanks. By *J. E. Revelle*, Chicago Bridge & Iron Co. September, Pp. 292-296.

Public Works

Good Public Relations Helps the Fluoridation Program. By *E. S. Biddle*, Delaware State Bacteriologist. October, Pp. 55-56.

The Surveyor (England)

Crawley New Town's 250,000 Gallon Prestressed Concrete Reservoir. Sept. 22, Pp. 591-592.

Water & Sewage Works

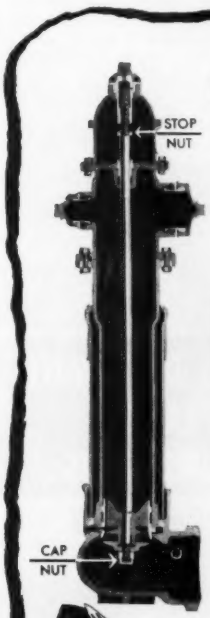
New Standpipe at Madison, Wis. By *Leon A. Smith*, Supt. of Waterworks & Sewerage. September, Pp. 371-375.
Residual Chlorine Recorder Experiences. By *Harry J. Krum*, City Chemist, Allentown, Pa. September, Pp. 376-379.
Freeport, L. I., Solves Its Water Loss Problem. By *George V. Maurer*, Supt. of Water. September, Pp. 380-381.
Leak Detection on Subaqueous Raw Water Intake Line By *George Hazey*, Chf. Operator of Filtration, Wyandotte, Mich. September, Pp. 382-384.
Collections and Complaints. By *A. E. Clark*, Mgr. Nashville Suburban Utility Dist. September, Pp. 385-386.
Mono- and Dichloramine Determinations in Water. By *Don B. Williams*, Chemist of Water Purification, Brantford, Ontario. October, Pp. 429-433.
Basic Factors in Centrifugal Pump Application. By *Roy Carter* and *Igor J. Karassik*, Worthington Pump & Mach. Corp. October, Pp. 434-437.
Computing Size of a Revenue Bond Issue. By *Geo. D. Russell*, Cons. Engr. October, Pp. 438-439.
Location of Buried Pipe and Hidden Leaks. By *Harold Bernard*, Eng. student, Univ. of Illinois. October, Pp. 440-441.
Iron and Manganese in Water Supplies and Methods of Removal. By *R. H. Babcock*, Sr. Chemist, Eckenfelder Assoc. October, Pp. 442-446.

Water Works Engineering

New Facilities Add 130 MGD of Well Water to Spokane Supply. By *James B. Fisken*, Water Engr. September, Pp. 852-855.
Water Works Experiences at Shreveport, La., Since 1887. By *Thomas L. Amiss*, Supt. Engr. of Water & Sew. September, Pp. 859-860, 896.
Supply and Storage Facilities Coordinated by Multicontrols. By *J. Reid Hobson*, Ex-Chf. Engr., and *Peter Ley*, Chf. Engr., Jamaica Water Supply Co. September, Pp. 861-862, 904.
Springfield, Ill., Plans Ahead for Twenty-five Years. By *S. T. Anderson*, Supt. Water, Light & Power Dept., and *W. G. Riddle*, Cons. Engr. September, Pp. 863-865, 922.
Reducing Unaccounted-for Water and Its Effect on Water Rates. By *L. A. Smith*, Supt. of W. W. & Sew., Madison, Wis. September, Pp. 867-868, 907.
Would Your Pumping Station Be Safe in Case of Fire? By *Robt. C. Dennett* and *Kenneth J. Carl*, Natl. Bd. of Fire Underwriters. September, Pp. 871-872, 912.
Painting Water Works Structures. Round Table Discussion. September, Pp. 886, 888, 905.

Danger of Water Main and Sewer in Same Trench

Recently the City of Towner, North Dakota, had a break in an old watermain and when they dug it up found that the water and sewer had been laid in the same ditch. Also, that ground around the break was completely saturated with sewage. There was no question that sewage had entered the broken main after it had been shut off, so a complete job of sterilizing a good portion of



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the water system was required before it was placed back into operation.

With this little incident, the city officials realized the danger of water and sewerage in the same ditch, so are proceeding to replace the old part of the system that was built in this manner. This will be accomplished by laying a new watermain and cutting off the old ones that are in the same ditch with the sewer.

TABLE 2.—Performance Data on Cathodic Protection System.

Trans. Tap. Fine	Trans. Tap. Coarse	Riser Current Min.	Riser Current Max.	Bowl Current Amps.	Voltage	Bowl Res.	Current Den. Bowl, ma/sq.ft.
1	1	.22	2.2	12.0	2.2	0.183	1.12
1	2	.30	2.5	14.0	2.5	0.178	1.31
1	3	.38	2.9	16.0	3.0	0.187	1.5
1	4	.40	Exceeds circuit	16.6	3.8	0.228	1.55
1	5	.50	fuse	20.8	4.5	0.216	1.95
5	5	.65		26.2	*6.0 (cal. 3.64)	0.229	2.47

*Present setting. Riser set at 2.0 amps or 0.9 ma/sq.ft.

Cathodic Protection

(*Continued from page 39*)

Total length of rod, bowl, 310 feet
Total length of rod, riser, 57.6 feet.

Resistance of Bowl Circuit

The lead wire to the bowl circuit is supplied through 180 ft. of #6 wire in conduit, and the bowl anodes and stubs are connected in parallel. The parallel circuit is supplied through 438 feet of #12 wire, 36 feet of #10 wire and 40 feet of #8 wire.

Resistance of #6 wire = 0.41 ohm/1000 feet.

For 180 ft.: R = 0.41 x 180 ÷ 1000 = 0.0733 ohm. The resistance of the parallel wire circuit can be neglected as it will be very small in comparison with that of the 180′ of #6 lead wire.

Applying formula (3): Resistance of bowl anodes where: L = Total length of anodes = 310 ft.; ρ = 570 ohm-cm; D = 71 ft.; A = 1 inch; and R_a = Resistance of anodes in ohms.

$R_a = 0.012 \times 570 \times \log_{10} (71 \div 1/12)$
$= 6.84 \times \log_{10} 852 \div 310$
$= 6.84 \times 2.93 \div 310$

$R_a = 0.645$ ohm.

Total resistance bowl circuit:

R line = 0.0738
R anodes = 0.0645
Total = 0.1383 ohm

Applying Ohm's law, E = IR and voltage required for 26.7 amps = 26.7 x .1383 = 3.7 volts.

Resistance of Riser Circuit

The riser is fed by a separate circuit from the rectifier. This is necessary to control the current to the riser anode since the surface area to be protected is small compared to the bowl. While the resistance of this circuit will be greater than the bowl circuit by reason of the greater length of rod employed in the bowl, it is not sufficient to compensate for the large amperage flowing to the total bowl area. Thus it is usually advisable to take the riser lead through a

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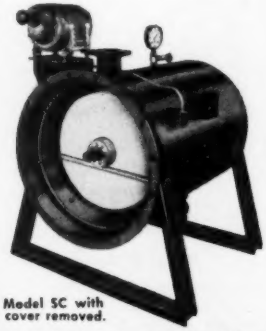

Model SC with cover removed.

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The Sparkler Model SC filter is ideal for swimming pools, municipal water systems, or large industrial uses because it provides a low-cost, self-cleaning means of filtration that meets the most exacting requirements for health and purity.

On the installation pictured here—a typical swimming pool—recirculated water from the 368,000 gallon pool consistently tests as class A—suitable for drinking. Both Enterococci MPN count and coliform MPN count are always less than 3, despite the fact that the pool carries a very large load of swimmers daily.

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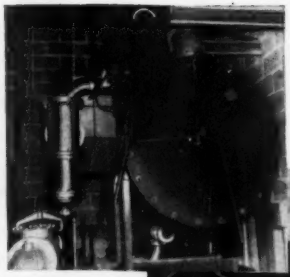
Model SC filters are available in sizes from 15 sq. ft. to 300 sq. ft. A Sparkler Field Engineer will be glad to discuss your particular problem with you.



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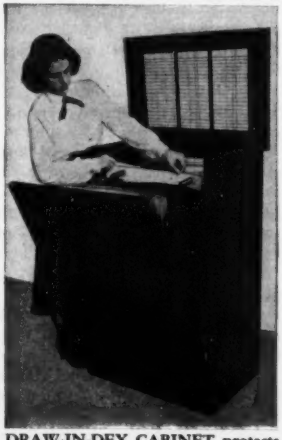

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variable resistor directly from the rectifier, and set the current on the riser where desired, regardless of bowl amperage.

The lead line employed in our case consisted of 30 ft. of #6 wire and 200 feet of #10 wire in series with a rheostat and separate ammeter at the rectifier. Thus the total lead resistance of the riser circuit would be computed as follows:

Resistance of #6 wire is .41 ohm/1000 ft.; for 30 ft., R = 0.41 x 1000 ÷ 30 = 0.0123 ohm. Resistance of #10 wire = 1.018 x 1000 ÷ 200 = 0.203 ohm. The total R lead = 0.215 ohm.

Applying formula 3 to the riser where: L = 57.7; ρ = 570; A = ¾"; and D = 10. Rr, the resistance of riser anode = 0.012 x 570 x $\log_{10}$ x (10 ÷ 0.0625) ÷ 57.7 = .012 x 570 x 2.2 ÷ 57.7 = 0.263 ohm.

Total circuit resistance is: in anode riser, 0.263; in R lead, 0.215, total 0.468 ohm.

Since the bowl voltage setting will be 3.7 volts at 26.7 amps, the riser amperage would be by Ohm's law: I = E ÷ R = 3.7 ÷ 0.466 = 7.93 amps or 7,930 ma.

The riser surface area is 2230 sq. ft., so current density would be 7,930 ÷ 2,230 = 3.55 ma/sq. ft.

As previously mentioned, a variable resistor was needed to limit this current density. Since voltage is determined by the bowl requirements, we can calculate the resistance required at 2.5 ma/sq. ft. as follows: 2230 sq. ft. (surface area in riser) x 2.5 ma/sq. ft. = 5,575 ma or 5.6 amps.

By Ohm's law: R imposed = 3.7 ÷ 5.6 amps = 0.66 ohm. It is to be noted that 2.5 ma is the maximum current density required. As previously mentioned, with a new paint coating, 0.5 ma/sq. ft. will probably be more than adequate to protect the metal surface. Thus, at 0.5 ma/sq. ft., I = 2230 x 0.5 = 1,115 ma or 1.15 amps. By Ohm's law: R imposed = 3.7 volts ÷ 1.15 amps =3.2 ohms. The rheostat installed had a maximum resistance of 12.0 ohms to allow latitude in service conditions.

To meet future operating conditions it was necessary to be liberal in selecting a rectifier. The water filling this tank is supplied from a Trinity Sands well approximately 2900 feet deep. All other areas in Dallas are from our surface supply. The latter contains an average of 165 ppm total solids giving a calculated resistance of:

ρ = 625,000 ÷ 165 = 3800 ohms. During the rainy season, solids go as high as 234 ppm giving a mini-

mum resistance of 2670 ohms, and as low as 130 ppm, giving a maximum resistance of 4800 ohms.

In view of the fact that the well will be ultimately abandoned, it was necessary that we purchase sufficient rectifier capacity to provide protection with the higher resistance water. Current requirements would remain within the original design basis of 2.5 ma/sq. ft. or a total of 26.7 amps; however, more pressure or voltage would be required. The resistance of the bowl circuit, using 4160 ohms as a median water resistance, would be 0.44 ohm. Adding to this the line resistance of 0.0738 ohm gives a total circuit resistance of 0.514 ohm. Thus by Ohm's law, to produce 26.7 amps: $E = 26.7 \times 0.514 = 13.7$ volts.

The rectifier available from stock meeting these requirements was a 12 volt, 26.7 amps Selenium rectifier. To limit voltage output until the higher resistance water would be available, a stepdown transformer was placed ahead of the rectifier. To compare actual results obtained with the design calculations, Table 2 gives performance data on the system as installed.

While it was not possible to duplicate the exact design current output, the calculated voltage at 26.2 amps is:

$E = IR = 26.2 \times 0.1388 = 3.64$ volts.

While the measured voltage was 6 volts, indicating an actual apparent resistance approximately 40% higher than the calculated, this variation is not as serious as it would seem. Due to the liberal use of anodes in this system, with a low resistance water, the anode resistance is extremely low and precise calculation is not important. Thus any resistance caused by rust or scale on the tank wall could cause proportionately greater error in actual resistance than if fewer anodes, with higher anode resistance, had been employed. As mentioned earlier, it is wise not to figure rectifier capacity too closely. The increment of cost required for surplus capacity is relatively small. If the tank in question had had any paint coating left at all, the actual resistance would probably have been several times that calculated since formula (3) is based on bare steel.

Actually, the presence of some paint coating would have been most advantageous since the current density required to protect the bare metal tank is somewhat higher than desirable. We are at this time giving consideration to re-painting the tank in addition to cathodic pro-

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tection to allow us to reduce the current densities now applied. In this regard, it is desired to repeat the warning as to the possibility of destroying paint coatings by applying too high a current density. It should be assured that the voltage drop across the paint coating is not excessive. It is pointed out in the Appendix C. of the reference, (1) the voltage required to overcome the film resistance should not exceed approximately one volt.

In conclusion, we have, by our experience in Dallas, gained considerable confidence in the economy and effectiveness of cathodic protection for controlling corrosion of steel surfaces submerged in water. There are a number of excellent firms who have available technically trained men properly to design and install these systems. It is important, however, to remember that the low bidder in this case is not always the best bid. It is suggested that all firms bidding on cathodic protection installations be required to submit a diagram showing the arrangement, size, and materials of the anode system which they propose to install. The voltage and amperage rating of the rectifier and type to be supplied should also be required by the specifications. As previously mentioned, it is advisable to require the company installing the cathodic protection system to run potential gradients along the tank bottom and walls to assure uniformity of protection. The installation of weighed test plates for subsequent checks as to the effectiveness of protection can also be required of the supplier or installed later to check the continued effectiveness of the system.

Cathodic protection, like any other system, requires maintenance if it is to prove satsifactory. If your city does not have personnel capable of inspecting and replacing anodes as required, it is suggested that a maintenance contract be made with those firms offering such service. A system of which part or all of the anodes have deteriorated and fallen into the tank is worse than no system at all since you have a false sense of security. Remember also that in cooler climates, icing on the water surface can destroy anodes, necessitating replacement each year as soon as the water temperatures return to normal. In these cases, it is generally desirable to design anode diameters only on the basis of one-year service and figure on replacement each spring.

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Dempster hopper on Elgin sweeper.

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Use coupon on page 85; circle No. 11-1

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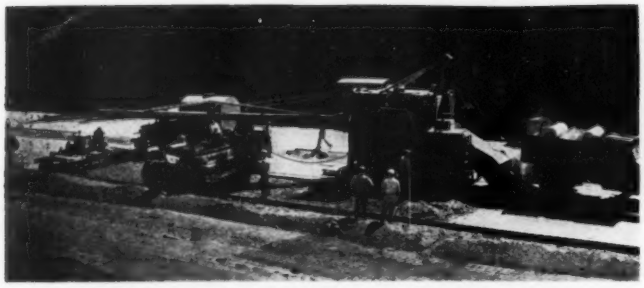

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Use coupon on page 85; circle No. 11-7

Rust-Proof Enameled Gages for Liquid Measurement

A complete line of porcelain enameled steel staff gages has been developed for the measurement of water, sewage and other liquids. These will not rust nor discolor. They are available with ratings of feet, tenths and hundredths for measuring depth; with graduations of cubic feet per second for measuring flow in weirs and flumes; and probably in gallons per minute or per day. Scales are black. Further information from Porcelain Enamel Institute, 1010 Vermont Ave., NW, Washington 5, D. C., or by using the coupon.

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This calculator, in pocket size, is available without cost to engineers and others who can use it in their work. It permits computing the comparative steam costs per 1000 lbs. using coal, oil or gas, based on fuel costs per ton, per gallon or per cubic foot. It takes into account the efficiency of the system. Other useful data are on the reverse side of the slide rule. Write Cleaver-Brooks Co., 326 East Keefe Ave., Milwaukee 12, Wisc., or use the coupon.

Use coupon on page 85; circle No. 11-9

Ice and Snow-Melting Chemical Pellets

These pellets, called "Melt," are reputed to have a much higher thawing capacity than normally used materials. They are applied sparingly over ice and snow surfaces. They are said to have great covering capacity and, if used at the start of a snow or ice storm, to melt subsequent falls. They are useful to thaw frozen gutters, pipes, sewers, streets and sidewalks. Data from The Chem Industrial Co., 1114 Hippodrome Bldg., Cleveland 14, Ohio, or by using the coupon.

Use coupon on page 85; circle No. 11-10

Make Your Highway Guards Last Longer

A protective plastic paint, called "Corrosite," forms a tightly bonded and impervious membrane over concrete surfaces and prevents chipping, even when guard rails are struck by fast-moving cars. The paint is elastic so that it withstands expansion and contraction, and it is not affected by alkalis in the concrete, salt, chloride or the weather. Good, also, for other concrete surfaces. More information from Corrosite Corp., Chrysler Bldg., New York, or by using the coupon.

Use coupon on page 85; circle No. 11-11

Paints Insects Away for Four Years

Dianol insecticide is mixed with paints of all types, interior or exterior, oil, water or dry, and kills all flying, crawling, chewing and sucking insects that crawl over it. Yet is completely odorless and nontoxic to humans and to household pets. It does not change the paint characteristics, nor modify the color. Usually, insects are killed within 15 minutes after contact. By actual test,

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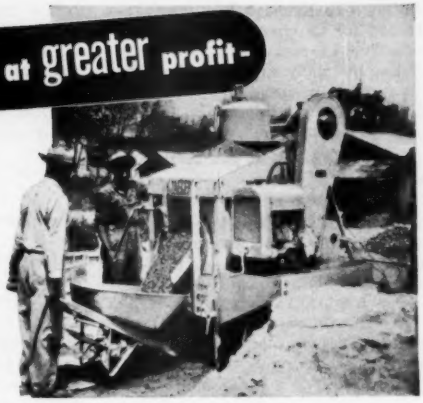

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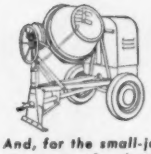

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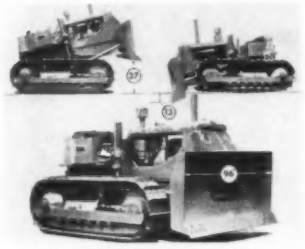
Use coupon on page 85; circle No. 11-12

No-Pushbeam Bulldozer

The 9-X Baker bulldozer for use with Allis-Chalmers tractors eliminates pushbeams and mounts an 8 ft. wide blade on the 70-hp 9-ton HD-9 tractor. This narrower blade has about the same total blade area as the 114-inch blade for the same tractor. A maximum rise of 37 ins. is provided for the blade, and a drop below ground level of 13 ins. In a field test, a refuse pit 8 ft. wide, 6 ft. deep and 50 ft. long at the bottom was dug in 80 minutes with only 81 passes. The short radius mounting held the approach to only 11 ft., while only 8 ft. were needed for coming out. Ask for Engineering Bulletin 896-A, Baker Mfg. Co., Springfield, Ill., or use the coupon.



How new bulldozer works.

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Screens with Parabolic Decks

These screens have a parabolic deck which causes material to spread immediately over the entire width of the screen, utilizing all of the available area. They are light in weight but constructed for long service. Double-deck screens are available where more than one size of aggregate is required. A special bulletin is available from Kolman Mfg. Co., West Twelfth St., Sioux Falls, S. D., or by using the coupon.

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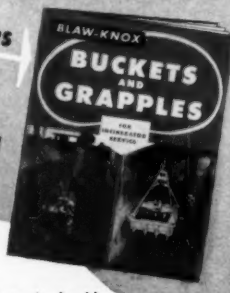

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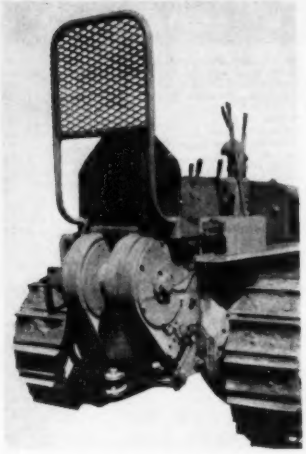

Hyster speed winch.

use with Caterpillar tractors, D4 model. It can be mounted on either seat or fender tank type equipment. Full data from Hyster Co., 2902 NE Clackamas St., Portland 8, Ore., or by using the coupon.

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Jobs for Engineers

An Assistant Director of Public Works is needed by Bangor, Maine. The announcement says: The job will be second in command to the City Engineer; annual budget of department is over $400,000; salary about $5000, plus non-cash dividends of good Maine living; must be a graduate engineer and have, or be eligible for, a Maine engineer's license. For more details, write Julian H. Orr, City Manager, Bangor, Me.

Frequent opportunities for sanitary engineers occur in the Alaska Department of Health, though vacancies did not exist as of September 4. Applications for positions by qualified engineers are welcomed. Write Amos J. Alter, Director, Division of Sanitary Engineering, Box 1931, Juneau, Alaska.

PERSONAL NEWS

Thomas C. Kirkwood has been made a member of the consulting engineering firm of A. C. Kirkwood & Associates, Kansas City, Mo. Mr. Kirkwood, who served in the Navy during the war, has been with the firm much of the time since it was organized.

Jack J. Hinman, Jr., returned from Guayaquil, Ecuador, on Sept. 1, but will go back there almost immediately for another six months supervision of the new filter plant. His address there will be Casilla No. 1305, Guayaquil, Ecuador, SA.

Samuel A. Greeley, one of our very fine and distinguished engineers, was honored by the Franklin Institute recently, being awarded the Frank P. Brown Medal. The award, for "leadership in the profession of sanitary engineering and his many contributions to knowledge in that field", will be fully approved by all who know him.

John R. Baylis, W. W. DeBerard and Harry E. Jordan were awarded special citations and Centennial Medallions at the Centennial celebration of Northwestern University on Oct. 19. The awards were made in recognition of the special services that these men have made to the water works profession. The occasion was the meeting of the Northern Illinois Water Works Institute.

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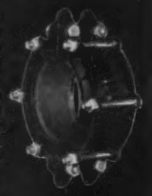

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73. "Pakmaster," a lightweight, high strength, sanitary packing for bell and spigot joints is easy to use and costs less per joint. Illustrated folder giving full information available from Sackner Products, Inc., 901 Ottawa Ave., Grand Rapids, Mich. Check the handy coupon.

pH—What It Is; and Recorders and Controllers

79. In a new 24-page bulletin The Bristol Co., Waterbury 20, Conn., presents a clear explanation of pH theory and its application to chemical processes. Suggested methods for automatic pH control for water and sewage treatment are diagrammed and typical installations pictured. Get your copy by checking the coupon.

●

SEWERAGE AND WASTE TREATMENT

What You Should Know About Trickling Filter Underdrains

20. Specifications for vitrified clay underdrain blocks conforming to ASTM standards, suggestions for layout and construction of trickling filter floors, dimensions of standard blocks, channel covers, angles and other fittings are available from the Trickling Filter Floor Institute, % Editor, Public Works, 310 E. 45th St., New York 17, N. Y. Check the coupon and we will forward your request.

Check This Service When Building Water or Sewage Plants

65. Experienced engineers and craftsmen of Municipal Service Company can help you by furnishing and installing mechanical equipment and piping for water and sewage plants. Nation wide service is available. Get full information on your current jobs by writing Municipal Service Co., M-1, 908 Grand Ave., Kansas City, Mo., or use the coupon.

Using Sewage Sludge Gas For Power Generation

90. Fairbanks-Morse dual fuel engines can operate on either sludge gas or oil to provide steady power output despite fluctuations in gas supply. Bulletins are available on several sizes to meet your needs. Write, giving exact requirements to Fairbanks, Morse & Co., Dept. PW, 600 So. Michigan Ave., Chicago 5, Ill., or use handy coupon.

Forms for Every Concrete Pipe Shape

95. In addition to this a complete line of forms for standard concrete sewer and drainage pipe, special forms for varied shapes of every type are listed in the Quinn Concrete Forms Catalog. Copies available by checking the coupon, or write direct to Quinn Wire and Iron Works, 1621 12th St., Boone, Iowa.

Need Low-Cost Air For Sewage Treatment?

122. New 20-page booklet shows operating and construction features of Rotary Positive Blowers engineered to fit your needs. Air for activated sludge, water treatment; constant vacuum for filtering. Bulletin 22-23-B-13 gives details. Roots-Connersville Blower Corp., 510 Poplar Ave., Connersville, Ind.

Comminutors for Automatic Disposal of Coarse Sewage Solids

152. The problems connected with disposal of coarse sewage solids are eliminated by clean, odorless, automatic Comminutors. Full engineering data show the proper model for every size plant and furnish details of hydraulics and typical installations. Chicago Pump Co., 2348 Wolfram St., Chicago 18, Ill.

Low Cost Power From Dual Fuel Engines

154. Operating on the Diesel cycle, burning either oil or gas, the Worthington Supercharged Dual Fuel Diesels give high economies by running on the cheapest fuel available. Get complete data from Worthington Pump & Machinery Corp., Dept. PW, Harrison, N. J.

Data Offered On Mixed Flow Pumps

201. Data on the complete line of Worthington Mixflo pumps of the two-vane, non-clogging sewage type is offered in 16-page bulletin W-317-H16. Salient features are outlined, typical sections, performance curves and general data for five types are included. Helpful charts aid shafting selection. Copies available by using coupon or from Worthington Pump and Machinery Corp., Harrison, N. J.

Data on Design of Grit Collectors and Washers

202. Grit collection and separation of organic materials from settled grit is described in Link-Belt Bulletin 1942. Typical installations are shown, and design data is provided, together with specifications. Use coupon for copy, or write Link-Belt Co., 2045 W. Hunting Park Ave., Philadelphia 40, Pa.

How Vacuum Filters Help Your Sewage Sludge Disposal

209. Applications of the Conkey sludge filter to all types of sewage sludge are described in Bulletin 100. Tables show filter sizes, weights, and give anticipated average results. Use the coupon to order your copy. General American Transportation Corp., Process Equip. Div., New York 17, N. Y.

●

WATER WORKS

The Modern, Streamlined Elevated Tank

32. A new 8-page bulletin describes the Watersphere, a modern elevated water tank of welded steel construction for general service gravity water pressure and fire protection. Construction details, illustrations of typical installations and table of standard sizes from 25,000 to 250,000 gallons capacity are included. Check the coupon. Chicago Bridge & Iron Co., 2115 McCormick Bldg., Chicago 4, Ill.

Do Your Water Mains Need Cleaning?

38. Literature on Flexible method of cleaning water mains any size from 2" to 72", giving full details and list of nearest representatives in all parts of country. Address: Flexible Underground Pipe Cleaning Co., 9059 Venice Blvd., Los Angeles, Calif.

Engineering Data on Diatomite Filters

44. Detailed information and typical plans of Sparkler diatomite filters for swimming pools of municipal water systems is available to engineers and municipal officials. These filters feature self-cleaning filter elements which cuts wash water to a minimum. Get this material now by using coupon. Sparkler Manufacturing Co., Mundelein, Ill.

The Turbidimeter Without Standards

51. The Hellige Turbidimeter is designed for accurate measurement of water turbidity, sulfate determinations, and measurements of suspended solids and colloids in general. No standards must be prepared for use with this instrument. Detailed description of working principle and the instrument itself covered in Catalog 8000-A, available from Hellige, Inc., Dept. PW, 3718 Northern Blvd., Long Island City 1, N. Y., or by checking handy coupon.

Helpful Installation Manual For Drainage Structures

62. A 46-page manual, well worth careful study by designers and field engineers dealing with drainage structures, culverts, sewers or conduits, is offered by Armco Drainage & Metal Products, Inc., Middletown, Ohio. Proper location of the structures, base preparation, assembly and backfill are some of the many items covered in detail. Use the handy coupon for free copy.

Efficient Coagulation With Ferri-Floc

69. Advantages claimed for Ferri-Floc as a coagulant include wide pH range, quick floc formation, manganese removal, control of certain tastes and odors, plus other aids in high quality water production. Check coupon for complete Ferri-Floc data. Tennessee Corp., Grant Bldg., Atlanta, Ga.

Modern Convenience for Soldering and Melting Metals

85. Insto-Gas torches and furnaces give trouble-free service for lead melting, soldering, all other jobs where a steady, clean, hot flame is needed. Convenient cylinders require no regulating gauges, attach directly to standard furnace assembly. Get Form 222 for full details by checking handy coupon. Insto-Gas Corp., Detroit 7, Mich.

The Modern Way to Filter Swimming Pool Water

104. That's the title of a bulletin full of facts about Bowser's new diatomite filter to produce clear, sparkling, clean water at low cost. Occupies small space, doesn't waste water. Gives sizes to use, performance charts, etc. Write Bowser, Inc., Dept. PW, Ft. Wayne, Ind.

Specs for Gate Valves

112. Rigidly inspected gate valves for pressures up to 175 lbs. by R. D. Wood Co. Sizes 2" to 30"; for any standard type joint. R. D. Wood Co., Public Ledger Bldg., Philadelphia 5, Pa.

How to Tap Concrete Pressure Pipe

126. The simple steps required in making a pressure tap in concrete pressure pipe are explained in a booklet issued by Lock Joint Pipe Company. Be sure you know how either large connections or small service outlets may be made economically and without sacrifice of strength. Just check the handy coupon. Lock Joint Pipe Co., Box 269, East Orange, N. J.

How to Keep Trenching Jobs on Schedule

24. The easy maneuverability of the tough, compact Cleveland Model 95 "Baby Digger" makes it well suited for the difficult job of trenching past the many obstacles of city

and suburban work. Multiple digging and crawler speeds handle all soil types and trench widths up to 24". Get Bulletin S-52 from Cleveland Trencher Co., 20100 St. Clair Ave., Cleveland 17, Ohio.

How Accurate Boring Speeds Underground Pipe Installations

135. Interesting charts showing earth boring costs, speed and accuracy for holes from 2½" to 14½" diameter and up to 80 feet long are included in 16-page Catalog No. 8 issued by Hydrauger Corp., 681 Market St., San Francisco 5, Calif. Specifications and general operating instructions are also covered.

Helpful Data on Mechanical Joints

138. Get Circular 49 from M & H Valve & Fittings Co. for important information and installation dimensions of M & H AWWA Mechanical Joint Valves and Hydrants. Features include ease of installation, construction economy, long life. Use coupon or write M & H Valve & Fittings Co., Anniston, Ala.

Helpful Data on Well Water Systems

173. A comprehensive, 48-page book on Layne Water Well Systems covers gravel wall wells, underreaming, cemented walls, rock wells and other well types. Applications of shutter screens and vertical turbine pumps are shown, together with water treatment and conditioning equipment. Ten pages are devoted to useful engineering tables and measurement data. Check the coupon today or write Layne & Bowler, Inc., Dept. PW, Memphis 8, Tenn.

Are You Ready Now To Make Main Repairs?

214. Broken water mains can quickly be repaired when you have "Skinner-Seal" Split Coupling Clamps on hand. Get Skinner Catalog 41 now—this handsome 40-page book shows how to make every type of pipe repair and covers a complete line of clamps to do the job quickly and easily. Just check the handy coupon for your copy. M. B. Skinner & Co., So. Bend 21, Ind.

Pollution-Proof Outdoor Drinking Fountain

144. A new outdoor drinking fountain so designed that contamination by cross connections or back siphonage is not possible is fully described in a 4-page bulletin. Features neat appearance, easy installation. Write Murdock Mfg. & Supply Co., 426 Plum St., Cincinnati 2, Ohio, or use coupon.

Faster Pipe Laying With Precaulked and Threaded Joints

148. McWane 2" cast iron water pipe with threaded joints and precaulked bell and spigot pipe are described in folder WM-47. Additional data on 3" to 12" centrifugally cast pipe and fittings in folder WL-47, both issued by McWane Cast Iron Pipe Co., Birmingham 2, Ala.

Complete Equipment for The Complete Pool

157. Latest equipment for recirculation, filtration, chlorination, softening and pH con-

MOBIL-SWEEPER

Better Sweeping for your money!

The big Mobil-Sweeper with its 2⅔ cu. yd. dirt hopper cleans more pavement... cleans it faster with fewer stops. It sweeps up and down steepest hills, around sharp corners. Cleans gutters slick as a whistle. The full-floating, self-aligning rear broom sweeps clean in deepest dips.

Whether you plan regular street sweeping or freeways and airports, too, you can get dual control, two gutter broom sweepers or the conventional sweeper to fit your needs. Mobil-Sweeper is the safest sweeper built. Four-wheel hydraulic brakes, steel-top cab, shatterproof windshield are all standard equipment. Protect your drivers and get cleaner streets with Mobil-Sweeper. Write today!

TWO GUTTER BROOM MODEL WITH DUAL DRIVING CONTROLS

CONVEYCO

MOBIL-SWEEPER
DIVISION OF THE CONVEYOR CO
3260 E. SLAUSON AVENUE
LOS ANGELES 58 CALIF.

THE CONVEYOR COMPANY
3260 East Slauson Avenue, Los Angeles 58, Calif. PW-11
Gentlemen:
Please send catalog with complete details and specifications for the Mobil-Sweeper.
Name_____ Title_____
Address_____ City_____
County_____ State_____

• USED • EQUIPMENT and CLASSIFIED ADVERTISING

USED EQUIPMENT FOR SALE

The City of Alpena is to receive bids for sale of the following listed equipment which is located in the municipally-owned Water Works Pumping Station. The generator has not been in use for the past eighteen years.

1 Bullock Generator, Amperes — 34.1, Volts — 2200, Frequency — 60, R.P.M. — 120.

1 Steam-driven Allis Chalmers Corliss twin expansion reciprocating engine to drive generator.

1 Bullock Exciter — steam operated. Volt Full Load — 120, Amperes — 100, R.P.M. —280.

The following transformers are attached to the above generator for conversion from 2 to 3 phase use:

1 Westinghouse main conversion transformer. Volts — 2300.

1 Westinghouse teaser conversion transformer. Phase — from 2 to 3.

Above equipment is complete.

4 Westinghouse Cooper Hewitt Mercury rectifier sets—converted to constant current transformer. Volts — 2300, Cycle — 60, Oil filled.

4 Westinghouse watt meters—single phase.

4 Westinghouse amp meters.

The following is also included:

4-inch piping running from steam-driven Corliss engine to 4-inch tee at header above exciter.

2-inch piping from exciter to 2-inch union above exciter.

Additional information can be received by contacting Mr. Martin Hanson, Superintendent of the Light Department, City of Alpena; or Morris Olsen, City Manager, City of Alpena, Michigan.

Bids will be received on the above listed equipment in the City Clerk's Office until Monday, December 10, 1951, at 5 P. M.

Please address your communication to the Mayor and Municipal Council and mark your envelope "Sealed Bid".

WANTED

"ENGINEER OF SANITATION, 35-50, responsible administrative engineering work in Health and Sanitation Division, Public Works Dept. Salary $5334-$6366 per year. Complete details by writing to Director of Personnel, Municipal Building, Hartford, Conn."

FOR SALE

1—24 TON NICHOLS-HERRESHOFF MULTIPLE HEARTH BURNER, USED ONLY A FEW MONTHS.

1—30 TON TRASH BURNER.

FOR FURTHER INFORMATION, CONTACT MR. J. R. PALMER, DIRECTOR OF PUBLIC WORKS, CITY HALL, ROCK ISLAND, ILL.

trol are described in Permutit Bulletin No. 2157. Manual and automatic valves explained and many installations diagrammed. Complete specifications given. Permutit Co., 330 West 42nd St., New York 18, N. Y.

Helpful Data on Corporation Stops

161. A complete line of brass goods for water works: corporation stops, curb stops, service pipe couplings, gooseknecks and other fittings are illustrated and described in catalog W-39, issued by A. Y. McDonald Mfg. Co., Dubuque, Iowa. Get your copy for ready reference.

What You Should Know About Meter Setting and Testing Equipment

166. Complete details on all equipment and proper methods for meter testing and installation are included in an excellent book published by Ford Meter Box Co., Wabash, Ind. All waterworks men concerned with setting and testing of water meters should have a copy of this book. Write for Catalog No. 50.

Locate Mains and Services Without Digging

186. A 16-page booklet tells how to use the Fisher "M-Scope" to locate buried pipes and valves by electronic means. Proper manipulation also determines depth of cover. Battery operated unit is readily carried by one man. Get data from Fisher Research Laboratory, Inc., 1961 University Ave., Palo Alto, Calif.

Does Your Water Works Have Standby Power?

224. Dependable Climax power plants are ready for emergency service to insure fire protection, and can also save power costs by peak load operation. Use the coupon for full data on Climax, 40 to 495 HP, operating on sewage or natural gas, butane or gasoline. Climax Engine & Pump Mfg. Co., 208 So. La Salle St., Chicago 3, Ill.

Investigate This Compact Flow Meter for Water

226. The Foster "Flow Tube" is a new metering element that is compact and easy to install. Bulletin FT illustrates simple element containing nozzles for differential pressure production and shows capacity range and accuracy. Made in standard type sizes. Foster Engineering Co., Union, N. J. will send copy, or use coupon.

Helpful Data on Main Sterilization

231. This detailed discussion of main and emergency sterilization indicates standard procedure, shows how to calculate quantities of sterilizing solution, describes equipment and gives typical specifications. All calculations can be solved by use of a simple chart. Use coupon to get your copy of Bulletin SM-9365. Proportioneers, Inc., 356 Harris Ave., Providence 1, R. I.

Have You Investigated The Chlorinizer?

273. Be sure to check the Builders-Providence "Chlorinizer" wherever chlorine gas is to be used. Wide range of metering for delivery of chlorine-water solution; long life control valve; safety features and many other points are covered in bulletin 840-G27, available from Builders-Providence, Inc., 356 Harris Ave., Providence 1, R. I. Check the coupon for your copy.

●

CIVIL DEFENSE

Get the Facts on Air Raid Sirens

86. There's more to be considered in air raid warning sirens than the loudness of the signal. Get complete information on efficient size and spacing of sirens from Federal Enterprises, Inc., 8733 So. State St., Chicago, Ill., by using coupon.

Civil Defense Communication Advisory Service

243. A free brochure designed to help your community with civil defense communications is available now from General Electric.

TO ORDER CHECK COUPON ON PAGE 85

Every civil defense official should have a copy. Order yours today by using handy coupon, or write Dept. PW, General Electric Co., Section 1041, Electronics Park, Syracuse, N. Y.

Protection Against Power Failure

149. Data on stationary, portable, and standby electric plants, AC and DC, are offered by D. W. Onan & Sons, Inc., 7654 University Ave., Minneapolis 5, Minn. Several bulletins cover diesel and gasoline-driven plants for every purpose. Just check the coupon for your copies.

Emergency Chlorination and Main Sterilization

213. Get data on portable emergency chlorination units designed to save time in cases of broken mains or substitute water supplies. Use coupon to order copies of publications 22-C; 58-C; and 408 from Wallace & Tiernan Co., Newark 1, N. J.

●

REFUSE COLLECTION AND DISPOSAL

A Working Plan for Community-Wide Garbage Grinding

30. In a descriptive booklet "Community-Wide Garbage-Free Living" a sound working plan is outlined for the installation of garbage grinders to eliminate the headaches of garbage collection and disposal, yet at the same time relieving the public officials of difficult financing problems. Get your copy from Given Mfg. Co., Dept. PW-8, 1250 Wilshire Blvd., Los Angeles 17, Calif. Use the coupon today.

Efficient Material Handling to Reduce Incineration Costs

130. Blaw-Knox Buckets specially designed for refuse and garbage handling are described in 22-page Bulletin 2350. Illustrations show progress of material through a modern municipal incinerator plant. Dimensions and incinerator bucket specifications are included. Blaw-Knox Div., 2124 Farmers Bank Bldg., Pittsburgh 22, Pa.

●

CONSTRUCTION EQUIPMENT AND MATERIALS

Investigate These Versatile Tractor Mounted Machines

28. Be sure to check the Traxcavator for the digging, grading, carrying and loading jobs handled by every public works department and contractor. Rated capacities range from ½ to 4 cubic yards. Full data on the Traxcavator and other machines engineered to match Caterpillar track-type tractors in Form 1106, published by the Trackson Co., Dept. PW-91, Milwaukee 1, Wis. Use coupon to order your copy.

How to Keep Your Loader On the Job

50. Don't take more time to move your loader to the job than to do the work. Investigate the Eagle Truck Mounted Loader for

handling gravel, sand, cinders, snow from windrows or piles. Get forms 444 and 947 from Eagle Crusher Co., Inc., Dept. PW, Galion, Ohio.

Municipalities Make Equipment Dollars Go Further

55. Be sure to get your copy of "Saving Facts" a new illustrated booklet prepared by The Oliver Corp. that shows how equipment dollars can be stretched on municipal work. Text and photos describe the application of tractors and money-saving attachments in street maintenance, snow removal, waste disposal, pipe laying and other projects. Write The Oliver Corp., Industrial Div., 19300 Euclid Ave., Cleveland 17, Ohio.

Data and Pictures of Complete Line of New Ford Trucks

58. Check this number on the coupon for colorful circular showing new Ford Trucks for every hauling need, available in great variety of standard, factory-built chassis and body combinations. Be sure to check these trucks on your job. Truck and Fleet Sales Dept., Ford Motor Co., Dearborn, Mich.

Safety Lantern With Pencil Beam Signal

77. Get information on the Dietz "Night Watch" Safety Lantern with special globe design that saves fuel by intensifying light rays into a pencil beam. Full details available from R. E. Dietz Co., Syracuse, N. Y. Just check the handy coupon.

Examining a Tractor Piece by Piece

99. The new 32-page catalog published by International Harvester Company should be studied by every tractor owner, for in it each unit from engine to track or the TD-9 Diesel is considered separately. These piece by piece discussions are supplemented by notes on easy servicing, versatile applications and attachments for every need. Get your couy of form CR-313-A from International Harvester Co., 180 N. Michigan Ave., Chicago 1, Ill., or check the handy coupon.

Your Property is Worth Good Protection

176. When installing link fence you want protection against rust and corrosion as well as vandalism. Investigate chain link fence made of "Konik" metal described in "Planned Protection" published by Continental Steel Corp., Kokomo, Ind.

Profitable Construction with Payloader

234. A comprehensive, 12-page catalog filled with on-the-job photos showing a wide variety of earth-moving, material-handling, lifting and carrying jobs being performed by the multi-purpose tractor-shovels known as "Payloaders" is now available. Helpful job data, specifications and features of the complete Payloader line are included, with illustrations of useful accessories. Copies of this colorful catalog No. 217 can be obtained from The Frank G. Hough Co., 761 Sunnyside Ave., Libertyville, Ill., or by checking the coupon.

●

STREETS AND HIGHWAYS

How the Mobil-Sweeper Can Improve Street Sweeping

23. Sweeping costs can be cut with the new Mobil-Sweeper which features safe highway speeds up to 55 mph, carries 2 2/3 cu. yd. dirt hopper, sweeps swath up to 10' wide with full floating brooms. Hills and deep gutters are no obstacle. Write to The Conveyor Co., 3260 E. Slauson Ave., Los Angeles 58, Calif. or use coupon for complete details on this machine.

Spreaders for Ice Control Save Labor and Speed Job

103. Only the driver is needed to spread salt or abrasives for ice control when a Flink Tail-Gate Spreader is used. Hydraulically driven, fully automatic unit is controlled from the cab. Further details in bulletin issued by The Flink Co., Dept. 11-S, Streator, Ill. Use coupon today.

End Dangerous Ice Hazards

111. Ice prevention on highways, streets and airport runways from Sterling "Auger Action" Rock Salt is described in bulletins from International Salt Co., Scranton, Pa. Check the coupon for your copies.

Eliminate Hazard of Loose Gravel on Roads

125. Accidents caused by loose gravel can be checked and costly gravel loss reduced by proper stabilization of your gravel roads. Investigate the low-cost stabilization and

gravel salvage methods offered by the Seaman Pulvi-Mixer. Bulletin "Stabilize Gravel Roads" is well worth studying. Check the coupon today. Seaman Motors, Inc., 305 N. 25th St., Milwaukee 3, Wis.

Helpful Bulletin Shows Roadbuilding Methods

141. Laying base or surface aggregates, free-flowing hot or cold bituminous mixtures and plant-mixed stabilized soil with the Jaeger paver type aggregate spreader are described and illustrated in Catalog SPS-1. Get data on this variety of roadbuilding methods and full specifications by checking the coupon. Jaeger Machine Co., 400 West Spring St., Columbus 16, Ohio.

Black-Top Paver Offers Many Advantages

150. The flexible Adnun Black Top Paver lays any asphalt mix, hot or cold, in widths from 6 ft. to 13 ft. Careful design lowers operating cost and cuts maintenance. Attachments spread stone, cinders or slag. Get full data on this machine by checking coupon. The Foote Co., 1954 State St., Nunda, N. Y.

Chemical Stops Salt Corrosion

174. A new chemical has been developed which, when mixed 1 pound to 100 pounds of salt, prevents any corrosion of automobiles by the salt. Harmless; colorless; odorless. Permits free use of salt for ice and snow control without complaint by drivers. Calgon, Inc., Pittsburgh, Pa.

Useful Data for Highway Builders In Barrett Road Book

198. The latest edition of "The Barrett Road Book" has 54 pages of helpful tables and step-by-step outlines of highway maintenance and construction with Tarvia and Tarvia-lithic. Tables show quantities per yard and mile; aggregate gradings; costs; many others. Get this useful book from Barrett Div., Allied Chemical & Dye Corp., 40 Rector St., New York 6, N. Y.

Clears Out the Snow In a Hurry

208. The husky Sicard "Snow Master Junior" is a low cost machine with big performance for loading snow on trucks or casting it to vacant areas. Wrist-action chute controls direction and angle of discharge. Get full data from Sicard Industries, Inc., 753 W. Main St., Watertown, N. Y., by using the coupon.

Snow Plows for Every Street and Highway Need

227. In a new bulletin, No. 51-F, full details are given on the Frink reversible trip-blade "Sno-Plow", which has special design features to eliminate chatter and to permit quick adjustment to nine plowing positions or scraping position for ice removal. Check the coupon for your copy. Frink Sno-Plows, Inc., Clayton, N. Y

Insurance Benefits For Civil Employees

256. Civilian government employees are offered insurance protection at the lowest possible cost by Government Employees Insurance Companies, Gov't Employees Insurance Bldg., Washington 5, D. C. Full details available by checking the coupon.

There is No DETOUR from SAFETY when DIETZ is on the Job

DIETZ NIGHT WATCH LANTERN

Burns 100 hours

Releases Straight-line Pencil Beam of great intensity, visible from all angles, nearby and at really great distances. Exclusive fresnel globe and trip-lock release of chimney.

First in safety—for safety first.

DIETZ RED GLOBE LANTERNS

The world's most reliable, portable light. Burn bright or dim for long hours, to the last drop of Kerosene, regardless of weather conditions. Economical. Available upon request with stamped-in "name" to prove your ownership.

DIETZ HIGHWAY TORCHES

Made better, to serve better. Non-tip base. Leak proof, and weather proof. Burn for 30 hours. Popularly priced and very economical, too.

R. E. DIETZ COMPANY
EST. SYRACUSE 1, N. Y. 1840
OUTPUT DISTRIBUTED THROUGH THE HARDWARE TRADE EXCLUSIVELY

FOR PRECISE pH Control and WATER TESTS

HELLIGE
NON-FADING
GLASS COLOR
STANDARDS
ARE AVAILABLE FOR

ALUMINUM
AMMONIA NITROGEN
BROMINE
CALCIUM
CHLORINE
CHROMATE
CHROMIUM
COLOR OF WATER
COPPER
DISSOLVED OXYGEN
FLUORIDE
HYPOCHLORITES
IRON
LEAD
MAGNESIUM
MANGANESE
NITRATE NITROGEN
NITRITE NITROGEN
pH CONTROL
PHOSPHATE
POLYPHOSPHATES
SILICA
SULPHIDES

Pocket Comparator No. 605

Hellige Glass Color Standards are safely mounted in unbreakable plastic frames. They are more convenient and economical. They never fade or change. THEY NEVER FAIL.

WRITE FOR NEW CATALOG No. 600-10

HELLIGE
INCORPORATED
3718 NORTHERN BLVD. LONG ISLAND CITY 1, N.Y.
HEADQUARTERS FOR COLORIMETRIC APPARATUS

WORTH TELLING . . .

by Arthur K. Akers

★ **Edward A. Phoenix,** who has been assistant manager of the Transite Pipe Department of **Johns-Manville Corporation,** New York, has been named as the manager of the newly-created Market Surveys Department of J-M. His new work will be to assist in plans for the market development of all J-M products.

★ We mentioned the big **General Electric Company** conference on civil defense communications at Syracuse in September. This picture and list indicates the calibre of attendants. Left to right,

they are: **Paul L. Chamberlain,** a General Electric sales manager; **Arthur W. Wallander,** civil defense director of New York City; **Brig. Gen. J. E. Smart,** vice commander, Eastern Air Defense Force; **S. N. Siegel,** director of radio communications, City of New York.

★ **Solvay Sales Division,** Allied Chemical and Dye Corporation, New York, has promoted **Col. John H. Elleman** to assistant director of sales. **Verne W. Aubel** succeeds him as manager of the calcium chloride department.

★ **Allis-Chalmers Manufacturing Company** elections include **W. G. Scholl,** now vice president in charge of sales for the tractor division; **J. F. Roberts,** vice president in charge of engineering, general machinery division.

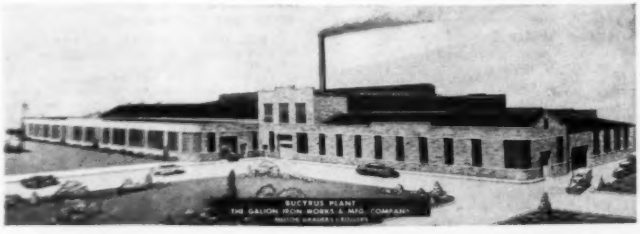
★ **Worthington Pump and Machinery Corporation,** Harrison, N. J., announces a new half-million dollar plant modernization job at Oil City, Pa. Also opening of its new branch sales office in the Hall Building, Harrisburg, Pa., in charge of **A. L. Mays.**

★ Contractors bidding on work for the Federal Government will be interested in a new booklet by **Henry W. Nichols,** general counsel of **National Surety Corporation.** Ask **J. A. Gernhardt** at the company's 4 Albany street address, New York, for yours.

★ **Pittsburgh - Des Moines Steel Company** has moved its eastern sales office to 1060 Broad Street, Newark 2, N. J.

★ **J. L. Nelson** is the new president of **N. P. Nelson Iron Works,** Clifton, N. J., manufacturers of material handling and truck loading equipment; succeeding N. P. Nelson, deceased.

★ Here is the newly-purchased factory of **The Galion Iron Works and Manufacturing Company** in Bucyrus, Ohio, some 12 miles west of the main offices and factory in Galion, Ohio. This ups Galion to over 30 acres of manufacturing floor space.

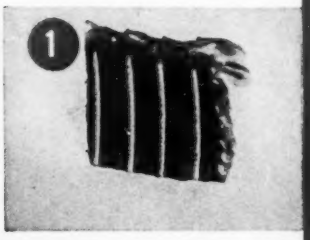


● ***NEW Bucyrus plant of Galion Iron Works & Mfg. Co.***

Get full details of this month's new products . . . mail your Readers' Service card today.

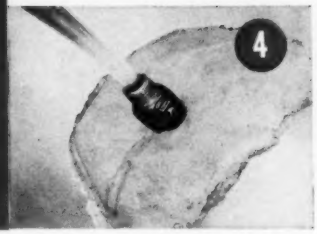
SERVICE CONNECTIONS are no problem in LOCK JOINT Reinforced Concrete CYLINDER PIPE

★ FITTINGS AND EQUIPMENT NECESSARY FOR MAKING SERVICE CONNECTIONS



HOW TO TAP

1. Remove concrete down to cylinder in area to be tapped.
2. Assemble fittings around bars of reinforcing cage, drawing gland down firmly so that gasket fits tightly against cylinder.
3. Mount tapping drill on corporation stop and tap.
4. When tap is completed, protect steel fittings with a cement mortar encasement.



Making a service connection under pressure in a Lock Joint Reinforced Concrete Cylinder Pipe is that simple.

Yet with these few steps a foolproof tap is always achieved. There can be no cross-threading, no loss of alignment and no damaging of the pipe with attendant costly shut-downs and repairs.

Lock Joint Pipe Company will be glad to furnish, at nominal cost, the few fittings necessary to make service connections from ¾" to 2" in diameter in any pressure pipe of Lock Joint design. Fittings are also available for making large diameter flanged connections—with ease under pressure. For illustrated instructions on tapping any type of Lock Joint Pressure Pipe, write for booklet, "Tapping Lock Joint Pressure Pipe Under Pressure."

LOCK JOINT PIPE COMPANY

Est. 1905

P. O. Box 269, East Orange, N. J.

PRESSURE PIPE PLANTS:
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SCOPE OF SERVICES

Lock Joint Pipe Company specializes in the manufacture and installation of Reinforced Concrete Pressure Pipe for Water Supply Distribution Mains in a wide range of diameters as well as Concrete Pipes of all types for Sanitary Sewers, Storm Drains, Culverts and Subaqueous Lines.

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